U.S. Department of the Interior
U.S. Geological Survey

U.S. Geological Survey Quality Assurance Project Plan for Bottom Sediment Thickness and Quality, Lower Neponset River, Massachusetts, with Analysis of Potential Contaminant Sources

By ROBERT F. BREAULT

Prepared in cooperation with the

MASSACHUSETTS EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS,

MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION, and the

U.S. ENVIRONMENTAL PROTECTION AGENCY

Northborough, Massachusetts
2002

CONTENTS

FIGURES

TABLES

APPENDICIES

1. Scoping Meeting Sign-in-sheet
2. Chain-of-custody
3. Quality-Assurance Plan for Water-Quality Activities in the Massachusetts-Rhode Island District
4. Project Proposals, Time/Task Plans, and Budgets or MA Coop Projects, Memorandum to Massachusetts-Rhode Island District Personnel, from S.G. Garabedian, 07-13-2001
5. Programs and Plans--10/40/70 Project Review Process, Memorandum to Massachusetts-Rhode Island District Personnel, from J.M. Norris, Assistant District Chief, 09-18-1995.
6. Chemical Hygiene Plan, USGS, WRD, Massachusetts-Rhode Island District Personnel, 07-15-1999.
7. Quality Control Data (Blank Samples) for Deionized Water Produced in the Massachusetts-Rhode Island District Laboratory, 07-1999 through 02-2002.
8. Policies and Procedures for the Management and Archival Storage of Data Collected for Basic Data and Hydrologic Investigations, U.S. Geological Survey, Massachusetts-Rhode Island District, 01-29-1999.
9 Helsel, D.R., and Hirsch, R.M., 1991, Statistical Methods in Water Resources: U.S. Geological Survey Techniques of Water-Resources Investigations, book 4, chap. A3
10. Users Manual for the national water information system of the U.S. Geological Survey, accessed September 10, 2002 at wwwnwis.er.usgs.gov/nwisdocs4_2/index.html
11. Wilde, F.D., Radtke, D.B., Gibs, Jacob, and Iwatsubo, R.T., 1998, Preparations for water sampling, *in* National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A1, accessed September 10, 2002 at water.usgs.gov/owq/FieldManual/chapter1/Ch1_contents.html

12. Wilde, F.D., Radtke, D.B., Gibs, Jacob, and Iwatsubo, R.T., 1998, Selection of Equipment for water sampling, *in* National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A2, accessed September 10, 2002 at water.usgs.gov/owq/FieldManual/Chapter2/Ch2_contents.html
13. Wilde, F.D., Radtke, D.B., Gibs, Jacob, and Iwatsubo, R.T., 1998, Cleaning of Equipment for water sampling, *in* National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A3, accessed September 10, 2002 at water.usgs.gov/owq/FieldManual/chapter3/Ch3_contents.html
14. Wilde, F.D., Radtke, D.B., Gibs, Jacob, and Iwatsubo, R.T., 1999, Collection of Water Samples, *in* National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A4, accessed September 10, 2002 at water.usgs.gov/owq/FieldManual/chapter4/html/Ch4_contents.html
15. Wilde, F.D., Radtke, D.B., Gibs, Jacob, and Iwatsubo, R.T., 2002, Processing of Water Samples, *in* National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A5, accessed September 10, 2002 at water.usgs.gov/owq/FieldManual/chapter5_V2/html/Ch5_contents.html
16. Wilde, F.D., and Radtke, D.B., 1998, Field Measurements, *in* National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6, accessed September 10, 2002 at water.usgs.gov/owq/FieldManual/Chapter6/Ch6_contents.html
17. Myers, D.N., and Wilde, F.D., 1998, Biological Indicators, *in* National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A7, accessed September 10, 2002 at water.usgs.gov/owq/FieldManual/Chapter7/index.html
18. Delzer, G.C. and McKenzie, S.W., 1999, Five-day biochemical oxygen demand: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A7, accessed September 10, 2002 at water.usgs.gov/owq/FieldManual/chapter7.2/pdf/chap7.2.pdfl
19. Radtke, D.B., 1997, Bottom-Material Samples, *in* National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations,

book 9, chap. A8, accessed September 10, 2002 at water.usgs.gov/owq/FieldManual/Chapter8/index.html

20. Lane, S.L., and Fay, R.G., 1997, Safety in Field Activities, *in* National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A9, accessed September 10, 2002 at water.usgs.gov/owq/FieldManual/Chap9/content.html
21. Colman, J.A., 2000, Source identification and fish exposure for polychlorinated biphenyl using congener analysis from passive water samplers in the Millers River Basin, Massachusetts: U.S. Geological Survey Water-Resources Investigations Report 00-4250, 44 p.
22. Breault, R.F., Reisig, K.R., Barlow, L.K., and Weiskel, P.K., 2000, Distribution and potential for adverse biological effects of inorganic elements and organic compounds in bottom sediment, Lower Charles River, Massachusetts: U.S. Geological Survey Water-Resources Investigations Report 00-4180, 70 p.
23. Versteeg, Roelof, White, E.A., and Rittger, Karl, 2001, Ground-penetrating radar and swept-frequency seismic imaging of shallow water sediments in the Hudson River: *in* Symposium on the Application of Geophysics to Engineering and Environmental Problems, Denver, Colorado, March 4-7, 2001, Proceedings: Wheat Ridge, Colo., Environmental and Engineering Geophysical Society, CD-ROM.
24. QC/QA at XRAL Laboratory
25. XRAL Laboratories Work Instructions
26. Axys Analytical Services' QA/QC Policies and Procedures Manual (Cover Only). Document available upon request.
27. U.S. Environmental Protection Agency, 1999, Method 1668, Revision A: Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by HRGC/HRMS: U.S. Environmental Protection Agency, Office of Water, EPA-821-R-00-002, (Cover Only). Document available upon request.
28. Axys Analytical Services' Analytical Method for the Determination of: Arolors, Total PCBs, Chlorinated Pesticides, PCB Congeners, Coplanar PCBs (Non-ortho-substituted, NOS), Toxaphene, Chlorobenzenes (Cover Only). Document available upon request

29. Axys Analytical Services' Analytical Method for the determination of 209 PCB congeners by EPA method 1668A (Cover Only). Document available upon request
30. Massachusetts Department of Environmental Protection, 1998, Method for the determination of extractable petroleum hydrocarbons; Massachusetts Department of Environmental Protection, Division of Environmental Analysis, 51 p.
31. Guy, Harold P., 1969, Laboratory theory and methods for sediment analysis: Techniques of Water-Resources Investigations of the U.S. Geological Survey, Book 5, Chapter C1.
32. U.S. Geological Survey, 1998, Quality-Assurance plan for the analysis of fluvial sediment by the Northeast Region, Kentucky District Sediment Laboratory: U.S. Geological Survey Open-File Report 98-384, 20 p.
33. National Institute of Standards & Technology Certificate of Analysis Standard Reference Material® 1944 New York/New Jersey Waterway Sediment.
34. National Institute of Standards & Technology Report of Investigation Reference Material 8704 Buffalo River Sediment.
35. U.S. Environmental Protection Agency, 1998, Guidance for data quality assessment, practical methods for data analysis, EPA QA/G-9 QA97 Version: U.S. Environmental Protection Agency, Office of Research and Development, EPA/600/R-96/084, variously paged.
36. U.S. Environmental Protection Agency, 1996, Region I, EPA-New England Data Validation Functional Guidelines for Evaluating Environmental Analysis, U.S. Environmental Protection Agency, Office of Environmental Measurement and Evaluation, variously paged.

PROJECT MANAGEMENT AND OBJECTIVES ELEMENTS

Title and Approval Page

Document title:

U.S. Geological Survey Quality Assurance Project Plan for Bottom Sediment Thickness and Quality, Lower Neponset River, Massachusetts, with Analysis of Potential Contaminant Sources

Lead organization:

U.S. Geological Survey, Water Resources Division Massachusetts-Rhode Island District (USGS MA-RI)

Prepares name and organizational affiliation:

Robert F. Breault, Hydrologist, U.S. Geological Survey, Water Resources Division Massachusetts-Rhode Island District

Prepares address and telephone number:

US. Geological Survey Water Resources Division Massachusetts-Rhode Island District
10 Bearfoot Road, Northborough, MA 01532,
(508) 490-5076

Preparation date: July 09, 2002

Project Manager:

Robert Breault, Hydrologist .... Date.......................
U.S. Geological Survey, 10 Bearfoot Road, Northborough, Massachusetts
(508) 490-5076
rbreault@usgs.gov

USGS Massachusetts-Rhode Island District Water-Quality Specialist:

Dr. Leslie DeSimone, Hydrologist .... Date.......................
U.S. Geological Survey, 10 Bearfoot Road, Northborough, Massachusetts
(508) 490-5023
ldesimon@usgs.gov

USEPA Chief Chemist:

Dr. William Andrade, Chemist .... Date.......................

U.S. Environmental Protection Agency Region I Environmental Services Division

11 Technology Drive North Chelmsford, MA 01863-2431

(888) 372-7341, (617) 918-8333

Andrade.Bill@epamail.epa.gov

USEPA Chief Quality Assurance Scientist:

Charles Porfert, Chemist .... Date.......................

U.S. Environmental Protection Agency Region I Environmental Services Division

11 Technology Drive North Chelmsford, MA 01863-243

(888)372-7341, (617) 918-8313

porfert.charlie@epa.gov

MADEP Quality Assurance Scientist:

Arthur Screpetist, Chemist .... Date.......................

Massachusetts Department of Environmental Protection, 627 Main Street

Worchester, MA 01608

(508) 767-2875

arthur.screpetis@state.ma.us

Document Control Format

The following document control format is used to identify the most current version of the quality assurance project plan (QAPP) and can be found at the top of each page of this document:

- USGS project name: S*ite Name/Project Name: Neponset River Sediment*
- The title of the document: *Title: Neponset River Sediment QAPP*
- The location of the study area: *Site Location: Neponset River, Massachusetts*
- The revision number: *Revision Number: X*
- The date of the original version: *Date of Original Version: 07/09/02*
- The date of the latest revision: Revision Date: *MM/DD/YY*
- The page number in relation to the total number of pages: *Page: XX of XX*

Document Control Numbering System

Those persons listed in table 1 are responsible for the distribution of revised or additional material, for updating any copies within their organizations, and for the removal of all outdated material from circulation.

Table 1. Document control numbering system

[QA, quality assurance]

Holders of controlled QAPP copies	Title	Organization	Telephone Number	Document control No.
Breault, Robert	Project manager and QA officer	U.S. Geological Survey	(508) 490-5076	USGS442519400
Pelto, Karen	River Restore Coordinator	Massachusetts Executive Office of Environmental Affairs	(617) 626-1542	USGS442519400
Faber, Tom	Project Manager	U.S. Environmental Protection Agency	(617) 918-8672	USGS442519400

QAPP Specifics

Guidance used to prepare QAPP: Region I, EPA-New England Compendium of Quality Assurance Project Plan Guidance: U.S. EPA-New England Region I, Quality Assurance Unit Staff, Office of Environmental Measurement and Evaluation, September 1998, Draft Final.

Program: River Restore

Approval entities:

- Massachusetts Executive Office of Environmental Affairs, Division of Environmental Protection - Department of Fisheries, Wildlife and Environmental Law Enforcement
- Massachusetts Department of Environmental Protection, Division of Watershed Management
- U.S. Environmental Protection Agency
- U.S. Geological Survey.

Status: QAPP is project-specific

Dates of scoping meetings: July, 26, 2002 and August 7, 2002

QAPP documents written for previous site work: None

Organizational partners:

- Massachusetts Executive Office of Environmental Affairs, Division of Environmental Protection - Department of Fisheries, Wildlife and Environmental Law Enforcement
- Massachusetts Department of Environmental Protection, Division of Watershed Management
- U.S. Environmental Protection Agency
- US Geological Survey

Data users:

- Massachusetts Executive Office of Environmental Affairs, Division of Environmental Protection - Department of Fisheries, Wildlife and Environmental Law Enforcement
- Massachusetts Department of Environmental Protection, Division of Watershed Management
- U.S. Environmental Protection Agency

QAPP elements not applicable:

- Field Equipment Calibration
- Field Analytical Method Requirements
- Field Analytical Quality Control

Distribution List and Project Personnel Sign-off Sheet

Those persons listed in table 2 will receive copies of the approved QAPP and any subsequent revisions of the QAPP. A complete copy of the original version and all revisions of the QAPP, including addenda and amendments, will be maintained on file by the USGS project manager at the USGS-WRD Massachusetts-Rhode Island (MA-RI) District Office in accordance with District Data Management Policy DPD #3, MA-RI District Administration Memorandum No. 98.01 (U.S. Geological Survey, 1997) and will be available upon request.

Table 2. Distribution List

[QAPP, Quality Assurance Project Plan; GIS, Geographic Information System; USGS, U.S. Geological Survey]

QAPP Recipients	Title	Organization	Telephone Number	Document Control Number
Andrade, William	Chemist	U.S. Environmental Protection Agency	(781) 860-4333	USGS442519400
Barlow, Lora	GIS specialist	U.S. Geological Survey	(508) 490-5007	USGS442519400
Breault, Robert	Hydrologist	U.S. Geological Survey	(508) 490-5076	USGS442519400
Colman, John	Hydrologist	U.S. Geological Survey	(508) 490-5027	USGS442519400
DeSimone, Leslie	USGS Massachusetts-Rhode Island District Water-Quality Specialist	U.S. Geological Survey	(508) 490-5023	USGS442519400
Faber, Tom	Project manager	U.S. Environmental Protection Agency	(617) 918-8672	USGS442519400
Pelto, Karen	River Restore Coordinator	Massachusetts Executive Office of Environmental Affairs	(617) 626-1542	USGS442519400
Porfert, Charles	Quality Assurance Officer	U.S. Environmental Protection Agency	(781) 860-4313	USGS442519400
Screpetis, Arthur	Quality Assurance Officer	Massachusetts Department of Environmental Protection	(508) 792-7650	USGS442519400
Sorenson, Jason	Hydrologist	U.S. Geological Survey	(508) 490-5107	USGS442519400
Waldron, Marcus	Section Chief	U.S. Geological Survey	(508) 490-5049	USGS442519400

All USGS project personnel performing work will perform the tasks as described. Signed personnel sign-off sheets will be forwarded to the central project file maintained by the project manager at the USGS-WRD Massachusetts-Rhode Island District Office in according with District Data Management Policy DPD #3, MA-RI District Administration Memorandum No. 98.01 (U.S. Geological Survey, 1997) and will be available upon request

Table 3. Project Personnel Sign-off Sheet

[GIS, Geographic Information System]

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read	QAPP Accept-able
Barlow, Lora	GIS Specialist	(508) 490-5007			
Breault, Robert	Hydrologist	(508) 490-5076			
Colman, John	Hydrologist	(508) 490-5027			
Sorenson, Jason	Hydrologist	(508) 490-5107			

Project Organization

Project Organizational Chart

Approval Authority:

- Massachusetts Department of Environmental Protection
- U.S. Environmental Protection Agency
- U.S. Geological Survey Water-Resources Division Massachusetts-Rhode Island District

Lead Organization:

US. Geological Survey Water Resources Division Massachusetts-Rhode Island District

10 Bearfoot Road, Northborough, MA 01532

Contract Organizations:

- XRAL Laboratories (416) 445-5755

  Role: Trace element analysis

  Lab Manager: Dr. Hugh de Souza

  www.XRAL@sgs.com

- U.S. Environmental Protection Agency (781) 860-4333

  Role: Organic compound analysis

  Chemist: Dr. William Andrade

  Andrade.Bill@epamail.epa.gov

  - Alpha Analytical (508) 898-1019

    Role: Extractable petroleum hydrocarbon analysis

    Lab Manager: Ellen Collins

    www.AlphaLab.com

- U.S. Geological Survey Iowa Sediment Laboratory (301) 358-3602

  Role: Grain-size distribution

  Lab Manager: Elizabeth Shreve

  eashreve@usgs.gov

- Axys Analytical Services Ltd. (250) 656-0881

  Role: Whole water PCB analysis

  Lab Manager: Georgina Brook

  gbrooks@axys.com

Communication Pathways

- If field sampling will be delayed, then the project manager from the field sampling contractor organization (USGS) will notify the USEPA contact Tom Faber, USEPA, Project Manager Faber.Tom@epamail.epa.gov (table 2).
- No data may be released to the public until approval is given by the Massachusetts Executive Office of Environmental Affairs, Massachusetts Department of Environmental Protection, U.S. Environmental Protection Agency, and U.S. Geological Survey.
- If the laboratory fails to accurately analyze a bottom sediment performance evaluation samples, then the project manager from the lead organization (U.S. Geological Survey Water-Resources Division Massachusetts-Rhode Island District) may require a rerun of that analysis.

Modifications to Approved Quality Assurance Project Plan

Any modification to the original QAPP will be documented and submitted for approval in the same manner as the original QAPP in accordance with Region I, EPA-New England Compendium of Quality Assurance Project Plan Guidance: U.S. EPA-New England Region I, Quality Assurance Unit Staff, Office of Environmental Measurement and Evaluation, September 1998, Draft Final (U.S. EPA-New England Region I, 1998). Project personnel listed in table 4 are authorized to initiate procedural modification of the original QAPP. All amendments or changes to the original QAPP (Document Control Number USGS442519400) will be immediately incorporated into the final version of the QAPP, will be distributed to those persons listed in table 2, and will be maintained by the USGS as a part of the central project file in accordance with Quality-Assurance Plan for Water-Quality Activities in the Massachusetts-Rhode Island District Water Resources Division U. S. Geological Survey (DeSimone, 2002). Only after the modification has been approved by the Massachusetts Executive Office of Environmental Affairs, Massachusetts Department of Environmental Protection, U.S. Environmental Protection Agency, and U.S. Geological Survey can the change be implemented. Initial verbal approval may be used to expedite project work; however, the QAPP modification must be documented immediately and submitted for formal approval.

Table 4. Persons Authorized to Initiate Procedural Modifications

[MA, Massachusetts]

Authorized to Initiate Procedural Modifications	Title	Organization	Telephone Number
Breault, Robert, U.S. Geological Survey, 10 Bearfoot Road, Northborough, MA 01532	Hydrologist	U.S. Geological Survey	(508) 490-5076
Waldron, Marcus, U.S. Geological Survey, 10 Bearfoot Road, Northborough, MA 01532	Section Chief	U.S. Geological Survey	(508) 490-5049

Personnel Responsibilities and Qualifications

Table 5. Personal Responsibilities and Qualifications

[GIS, Geographic Information System; QA/QC, Quality Assurance Quality Control; MA, Massachusetts; RI, Rhode Island; Rd, Road; MS, Masters of Science; Ph. D., Doctorate of Philosophy; BS, Bachelors of Science]

Name	Title	Affiliation	Responsibilities	Location of Personal Resumes	Education and Experience Qualifications
Barlow, Lora	GIS specialist	USGS	GIS	U.S. Geological Survey, Water Resources Division Massachusetts-Rhode Island District 10 Bearfoot Rd., Northborough, MA 01532	MS. Civil Engineering
Breaut, Robert	Project manager, project QA officer	USGS	Coordinates all project activities and directs all project QA/QC activities	U.S. Geological Survey, Water Resources Division Massachusetts-Rhode Island District 10 Bearfoot Rd., Northborough, MA 01532	Ph. D. Candidate Chemistry, MS. Chemistry
DeSimone, Leslie	MA-RI District Water-Quality Specialist	USGS	Oversees project QA/QC activities	U.S. Geological Survey, Water Resources Division Massachusetts-Rhode Island District 10 Bearfoot Rd., Northborough, MA 01532	Ph. D. Hydrology
Sorenson, Jason	Field sampler	USGS	Sediment sampling and ground penetrating radar data collection and interpretation	U.S. Geological Survey, Water Resources Division Massachusetts-Rhode Island District 10 Bearfoot Rd., Northborough, MA 01532	MS. Candidate Geophysics, BS. Environmental Science
Waldron, Marcus	Section chief	USGS	Overseas personnel issues and provides technical and policy oversight.	U.S. Geological Survey, Water Resources Division Massachusetts-Rhode Island District 10 Bearfoot Rd., Northborough, MA 01532	Ph. D. Ecology

Special Training Requirements and Certification

Table 6. Special Personnel Training Requirements

[GIS, Geographic Information System; USGS, U.S. Geological Survey]

Project Function	Specialized Training Title of Course and Description	Training Provided By	Training Date	Personnel/Groups Receiving Training	Personnel Titles/Organizational Affiliation	Location of Training Records/ Certificates
Boat safety	Boat Safety	U.S. Geological Survey	07-15-96	Robert Breault, John Colman, Jason Sorenson	Project personnel, USGS	U.S. Geological Survey, Water Resources Division, Massachusetts-Rhode Island 10 Bearfoot Rd. Northborough, MA 01532
GIS	Advanced Arc/Info, GRID, Spatial Analysis	U.S. Geological Survey	11-15-98	Lora Barlow	Project personnel, USGS	U.S. Geological Survey, Water Resources Division, Massachusetts-Rhode Island 10 Bearfoot Rd. Northborough, MA 01532
Ground Penetrating Radar	On the job training	U.S. Geological Survey	10-30-97	Robert Breault, Jason Sorenson	Project manager/ Project personnel, USGS	U.S. Geological Survey, Water Resources Division, Massachusetts-Rhode Island 10 Bearfoot Rd. Northborough, MA 01532
Laboratory Safety	Laboratory Safety	U.S. Geological Survey	09-15-99	Robert Breault, Lora Barlow, John Colman, Jason Sorenson	Project manager/ Project personnel, USGS	U.S. Geological Survey, Water Resources Division, Massachusetts-Rhode Island 10 Bearfoot Rd. Northborough, MA 01532
Quality Control	Quality Control Sample Design and Interpretation	U.S. Geological Survey	03-05-01	Robert Breault	Project personnel, USGS	U.S. Geological Survey, Water Resources Division, Massachusetts-Rhode Island 10 Bearfoot Rd. Northborough, MA 01532
Safety	First Aid	American Red Cross	07-01-02	Robert Breault, Lora Barlow, John Colman, Jason Sorenson	Project chief and field samplers, USGS	U.S. Geological Survey, Water Resources Division, Massachusetts-Rhode Island 10 Bearfoot Rd. Northborough, MA 01532

Project Planning and Problem Definition

Project Planning Meetings (Scoping Meetings) Documentation

See appendix 1 for project scoping meeting attendance sheets and agendas.

Problem Definition and Site History and Background

The Neponset River is unique among the three major rivers discharging to Boston Harbor. Unlike the Lower Charles River -which has been converted into a water park for recreation, and the Lower Mystic River -which is dedicated to shipping and industrial uses, the Lower Neponset River has retained its character as a natural estuary. Moreover, the Neponset River estuary supports the largest remaining salt marsh ecosystem in Boston Harbor.

In recent years, the ecological value of the Lower Neponset River has been recognized, and the Massachusetts Executive Office of Environmental Affairs (EOEA) is now spearheading efforts to restore the ecosystem (www.state.ma.us/envir/mwrp/active.htm). An important aspect of this restoration effort is to provide upstream passage for anadromous fish species, in some cases by dam removal. Before dam removal is undertaken, however, the quantity and quality of sediments impounded behind selected dams needs to be well characterized. To the extent possible, specific sources of the sediment contaminants (for example, PCBs) also need to be identified. In order to restore passage to anadromous fish by dam removal, EOEA managers need to know, at a minimum, the contaminant levels present in the impounded bottom sediment upstream of the dams.

Project Description and Schedule

Project Overview

Water depths will be measured in the two impoundments (Baker and Tilestone-Hollingsworth Dams) and intervening river reaches upstream by means of an echo sounder (fig. 1). The echo sounder unit emits acoustic (or sound) waves through a transducer mounted on the stern of a small boat. This energy passes through the water column until it enters the Bottom sediment. Some of the energy is reflected and detected at the surface by the transducer. The difference between the water surface and the bottom is displayed on the monitor as the depth. A global positioning system (GPS) will be used to locate each depth sounding site precisely.

Figure1. Instrumentation for collecting water depth

Sediment thickness data will be collected using Ground Penetration Radar (GPR) (fig. 2). GPR is a versatile geophysical-survey method that can be used in water as shallow as 15 cm (6 in), is capable of adequate penetration of earth sediments with detailed resolution, and is not affected by aquatic vegetation. GPR recording equipment and antenna are towed in an inflatable raft, while latitude and longitude are determined using a GPS. GPR systems emit short pulses of electromagnetic energy from a transmitting antenna. The energy enters the sediment (in this study, the water column and bottom sediments in the impoundment) and passes through the sediment until it encounters an interface between sediments (like sediment-water and sediment-bedrock) having different dielectric constants. At such interfaces, some of the energy is reflected. The reflected energy is detected by a surface receiver, and the travel time and strength of the signal is recorded. Bottom sediment thicknesses are calculated by travel times interpreted from graphical radar GPR records and radar wave velocities.

Figure 2. Collection of sediment thickness data (left) using ground penetrating radar instrumentation (right).

Channel morphology and the thickness of river-bottom sediments will be mapped from water-depth and sediment-thickness data using a combination of the triangular irregular network (TIN) data model and topogrid functions of ESRI's ARC/INFO geographic information system (GIS) software (Environmental Systems Research Institute Inc., Version 7.11). The total volume of bottom sediment in each impoundment will be determined using the TIN data model of ARC/INFO. This methodology was used in mapping sediments in the Lower Charles River Basin (Breault and others, 2000).

Approximately 20 surficial samples will be collected using a random sampling design, to facilitate statistical treatment of the data (fig. 3). These 20 sampling sites will be selected by dividing the river into 30 m^2 cells that will be randomly selected for sampling using a subroutine within the ARC/INFO GIS software (Scott, 1990 ok.water.usgs.gov/abstracts/wrir90-4101.html). GPS will be used to locate the cells in the field and to locate the selected sample sites precisely within those areas.

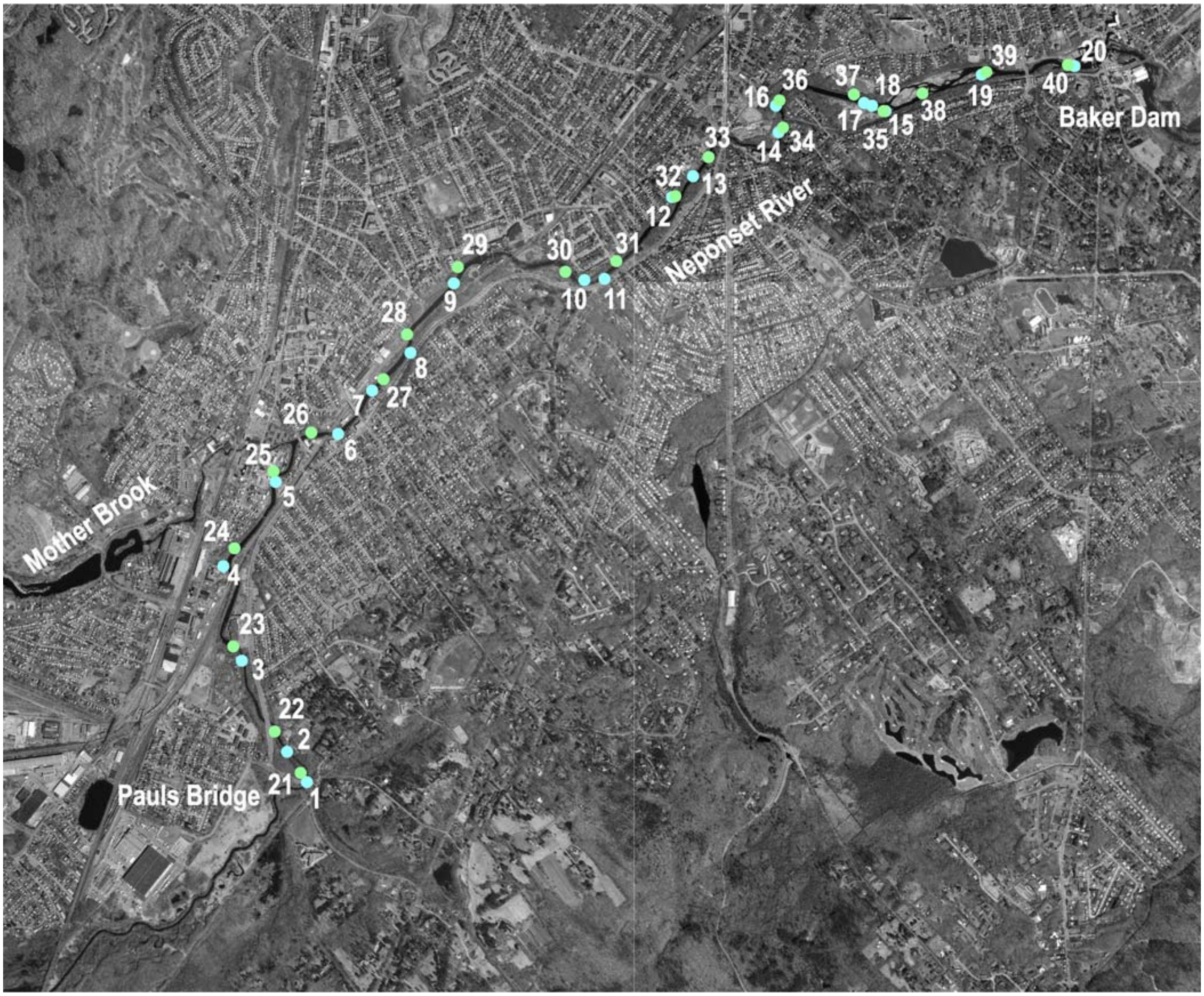

Figure 3. Location of Primary (●) and Secondary (●)Surficial Sediment Sampling Stations, Neponset River, Massachusetts

A stainless-steel Eckman dredge grab sampler will be used to collect the surficial- sediment samples (fig.4). The Eckman sampler will be deployed several times at slightly different locations at each sampling site to provide an adequate sample volume and to ensure the collection of a representative sample. In the field, water trapped in the dredge will be decanted after time has been allowed for the fine-grained sediment to settle. The top 10 cm of sediment will be removed from the dredge and placed in a pre-cleaned stainless-steel bowl and homogenized with a stainless-steel spatula. Subsamples will be collected and placed in pre-cleaned containers. The stainless-steel Eckman dredge, bowl, and spatula will be decontaminated in the field between samplings by rinsing with phosphate-free detergent, tap water, and deionized water, in that order. Stainless-steel sampling and processing equipment was chosen as opposed to non-metallic as suggested by Radtke(1997). Stainless-steel sampling and processing equipment is appropriate for collecting sediment samples to be analyzed for inorganic constituents, provided that the sample-contacting portion of the sampling device is not scratched or otherwise marred or damaged so as to release metallic substances for which the sample is being analyzed (Franceska Wilde, 2002, written commun.).

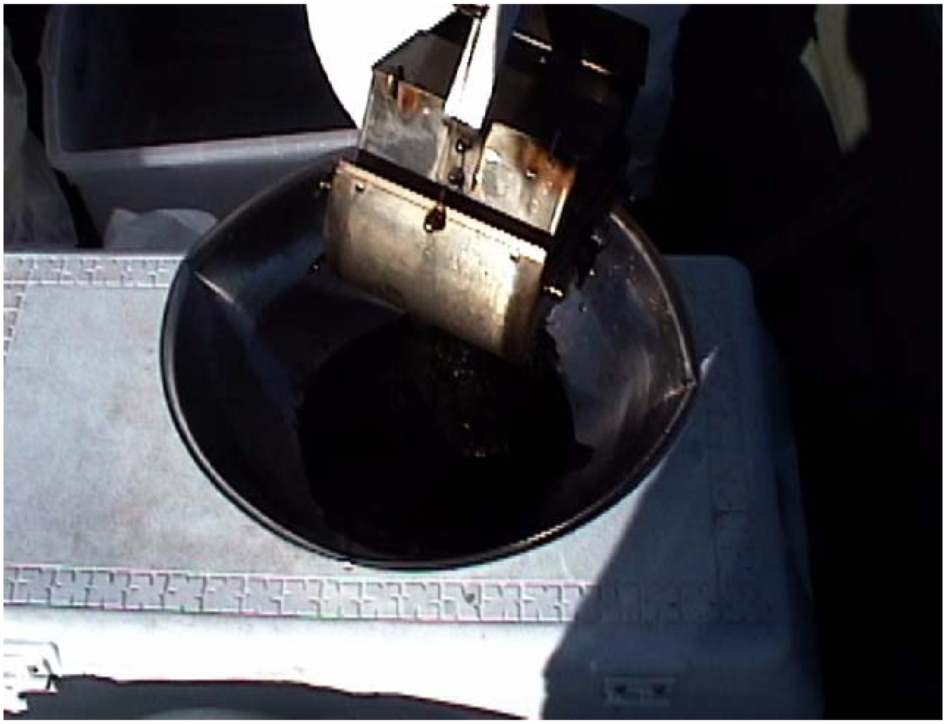

Figure 4. Stainless-steel Eckman dredge grab sampler

In addition, approximately 32 cores will be collected in depositional zones upstream of the Baker Dam, including both impoundments (Baker and Tilestone-Hollingsworth, fig. 5) and intervening free-flowing reaches (the braided channel area, fig. 6); the exact number and locations will be chosen in consultation with the Massachusetts Executive Office of Environmental Affairs, Massachusetts Department of Environmental Protection, and U.S. Environmental Protection Agency, with consideration given to the location of suspected contaminant sources. These cores will extend to the interface with pre-dam sediment, or to a maximum depth of about 1-meter. Approximately 3 cores will also be collected in the tidal estuary, to assess background contaminant concentrations downstream of the Baker Dam.

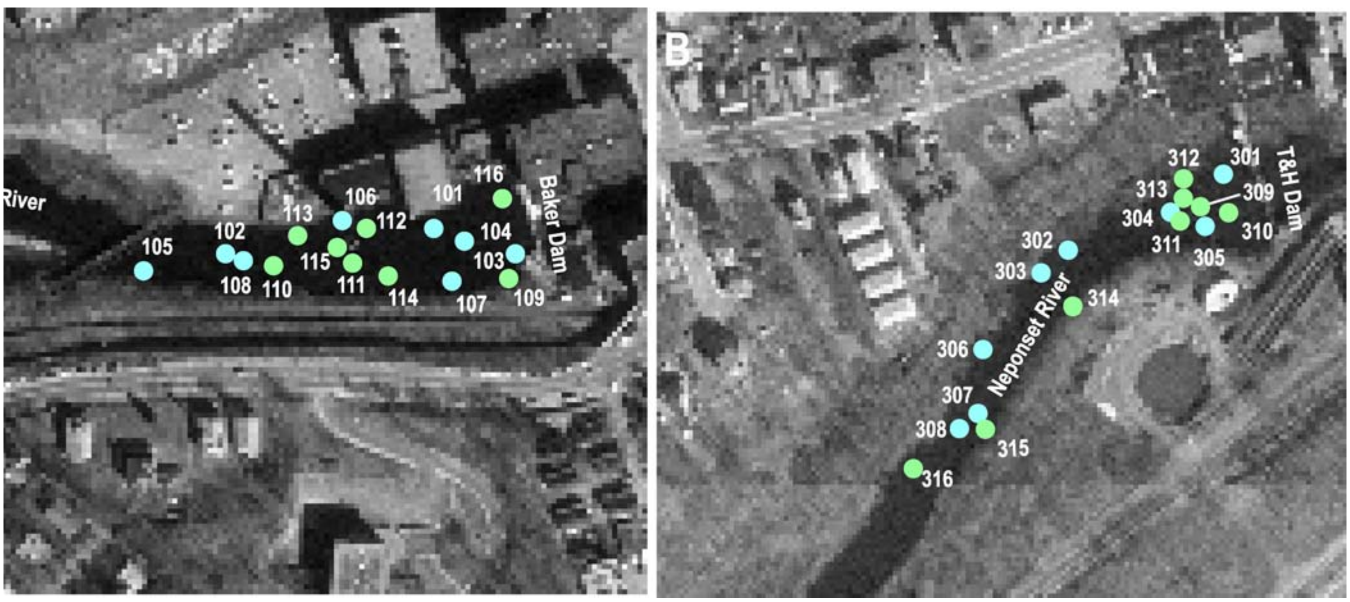

Figure 5. Location of Primary ( ) and Secondary ( ) Core Sampling Stations, T&H and Baker Dam Impoundments, Neponset River, Massachusetts

Figure 6. Location of Primary ( ) and Secondary ( ) Core Sampling Stations, Braided Channel, Neponset River, Massachusetts

Cores will be collected using a piston corer (fig. 7). Sediment will be removed from the piston corer and placed in a pre-cleaned stainless-steel bowl and homogenized with a stainless-steel spatula. Subsamples will be collected and placed in pre-cleaned containers. The piston corer, bowl, and spatula will be decontaminated in the field between samplings by rinsing with phosphate-free detergent, tap water, and deionized water, in that order.

Figure 7. Sediment sampling using a stainless-steel piston corer

Sediment samples will be analyzed for (1) inorganic trace elements including, but not limited to, arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc, and (2) organic contaminants, including PCBs, organochlorine pesticides, PAHs, TPHs, and total organic carbon (TOC). Grain size, percent moisture, and total solids will also be determined.

Quality control samples will be collected including split field samples (or replicates) and concurrent replicate samples (or field duplicates). Split field samples will be collected by taking an aliquot of the, already collected, homogenized, processed and preserved sample and placing it in to a pre-labeled clean sample jar -these samples will be analyzed for the same constituents as the “original sample”. In addition, concurrent replicate field samples (or field duplicates) will also be collected. Concurrent sampling will be done in accordance with standard USGS protocols (Radtke,1997). Finally, an equiptmemt blank will be collected to ensure that sampling equipment and processing is not a source of sample contamination.

Passive PCB samplers will be deployed at approximately 12 locations in the Neponset River study reach, following procedures detailed by Litten (1993) and Colman (2000)(fig. 8). Sites will be located up- and downstream of suspected tributary PCB sources, such as Mother Brook, as well as within selected tributaries. The PCB samplers each contain 0.2 L of hexane and are fitted with a polyethylene membrane (fig. 9). Dissolved PCBs diffuse out of the river water-column through the membrane during a 2-week deployment period, providing a time-integrated sample of PCBs in the river water passing the sampling point. Two replicate samplers will be deployed at five of the ten sites for quality assurance. If necessary, a second round of samplers will be deployed to better define potential source locations.

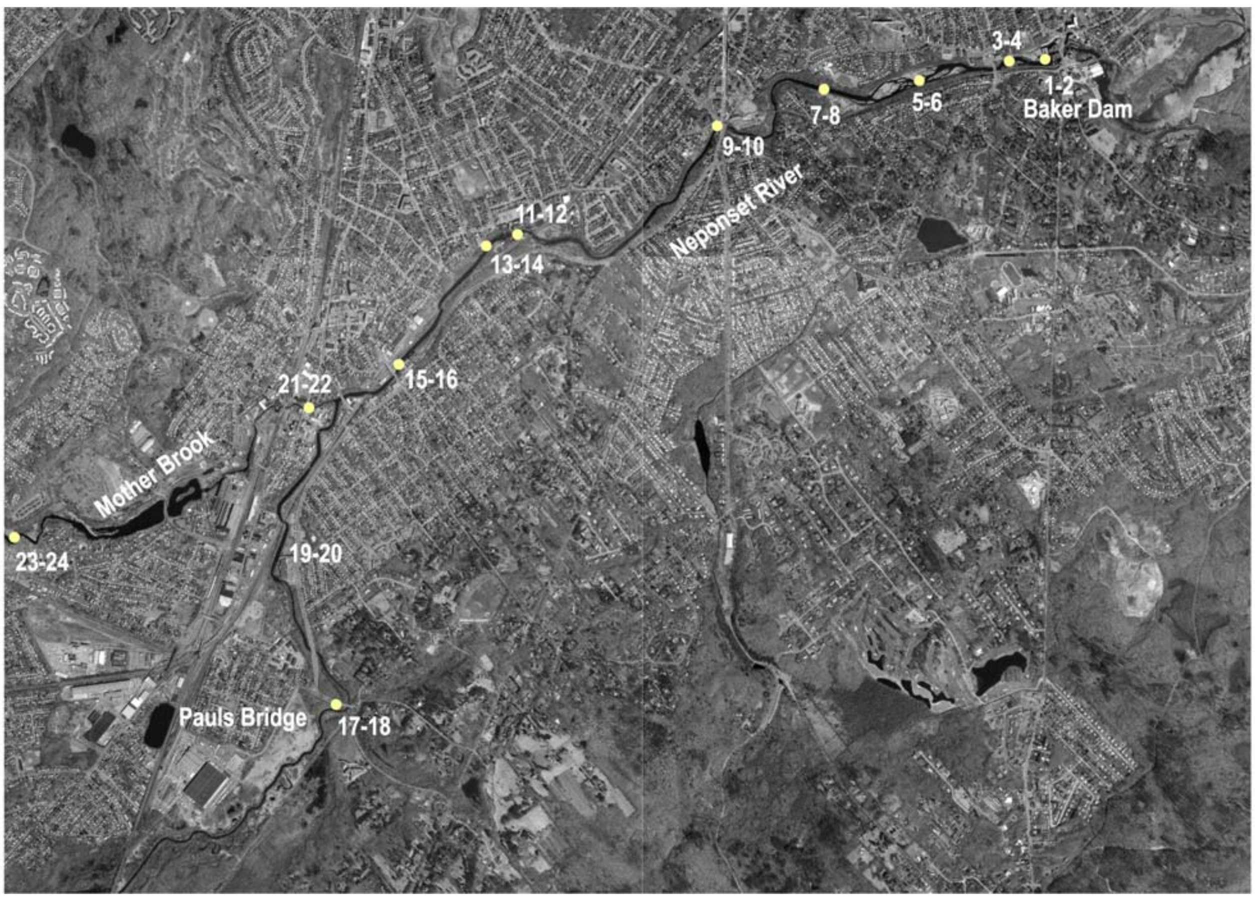

Figure 8. Location of PCB Sampling Stations, Neponset River, Massachusetts

Figure 9. Deployment of PCB Passive Sampler

Table 7. Contaminants of Concern and Other Target Analytes

[Whole Water Concentrations are wet weight; Bottom sediment concentrations are dry weight; PCB, polychlorinated biphenyls; EPH, Extractable petroleum hydrocarbons; PAH, polyaromatic hydrocarbons; ppm, parts per million; MDL, method detection limit; NA, not applicable; e, value is estimated and depends on the number of chlorines on conger]

Analyte	Project Action Limit (ppm)	Project minimum reporting limit (ppm)	Analytical Method (MDLs) (ppm)
[1]PCBs, water	NA	e0.000005	e0.00002
[2]PCBs, bottom sediment	0.17	0.017	0.005
EPH, bottom sediment	See SOP	See SOP	See SOP
[3]PAHs, bottom sediment	0.17	0.017	0.005
[4]Pesticides, bottom sediment	0.008	0.0008	0.0002
Aluminum, total, bottom sediment	3,000	333	100
Antimony, total, bottom sediment	200	16.5	5
Arsenic, total, bottom sediment	100	9.9	3
Barium, total, bottom sediment	30	3.3	1
Beryllium, total, bottom sediment	20	1.65	0.5
Bismuth, total, bottom sediment	200	16.5	5
Cadmium total, bottom sediment	10	3.3	1
Calcium, total, bottom sediment	3,000	333	100
Chromium, total, bottom sediment	10	3.3	1
Cobalt, total, bottom sediment	10	3.3	1
Copper, total, bottom sediment	20	1.65	0.5

Table 7. Contaminants of Concern and Other Target Analytes

[Whole Water Concentrations are wet weight; Bottom sediment concentrations are dry weight; PCB, polychlorinated biphenyls; EPH, Extractable petroleum hydrocarbons; PAH, polyaromatic hydrocarbons; ppm, parts per million; MDL, method detection limit; NA, not applicable; e, value is estimated and depends on the number of chlorines on conger]

Analyte	Project Action Limit (ppm)	Project minimum reporting limit (ppm)	Analytical Method (MDLs) (ppm)
Iron, total bottom sediment	3,000	333	100
Lanthanum, total, bottom sediment	20	1.65	0.5
Lead, total, bottom sediment	100	6.6	2
Magnesium, total, bottom sediment	3,000	0.033	0.01
Molybdenum, total, bottom sediment	30	3.3	1
Nickel, total, bottom sediment	30	3.3	1
Phosphorus, total, bottom sediment	3,000	333	100
Potassium, total, bottom sediment	3,000	333	100
Scandium, total, bottom sediment	20	1.65	0.5
Silver, total, bottom sediment	10	0.66	0.2
Sodium, total, bottom sediment	3,000	333	100
Strontium, total, bottom sediment	20	1.65	0.5
Tin, total, bottom sediment	300	33	10
Titanium, total, bottom sediment	3,000	333	100
Tungsten, total, bottom sediment	300	33	10
Vanadium, total, bottom sediment	70	6.6	2
Zinc, total, bottom sediment	20	1.65	0.5

Table 7. Contaminants of Concern and Other Target Analytes

[Whole Water Concentrations are wet weight; Bottom sediment concentrations are dry weight; PCB, polychlorinated biphenyls; EPH, Extractable petroleum hydrocarbons; PAH, polyaromatic hydrocarbons; ppm, parts per million; MDL, method detection limit; NA, not applicable; e, value is estimated and depends on the number of chlorines on conger]

Analyte	Project Action Limit (ppm)	Project minimum reporting limit (ppm)	Analytical Method (MDLs) (ppm)
Zirconium, total, bottom sediment	20	1.65	0.5
Total Organic Carbon bottom sediment	NA	333	100
Grain-Size distribution bottom sediment	NA	NA	NA

[1] PCBs, whole water include: 2,6-Dichlorobiphenyl; 2,2’-Dichlorobiphenyl; 2,4-Dichlorobiphenyl; 2,5-Dichlorobiphenyl; 2,3’-Dichlorobiphenyl 2,4’-Dichlorobiphenyl; 2,3-Dichlorobiphenyl; 4,4’-Dichlorobiphenyl; 2,2’,6-Trichlorobiphenyl; 2,2’,5-Trichlorobiphenyl; 2,2’,4-Trichlorobiphenyl; 2,3,6-Trichlorobiphenyl; 2,3’,6-Trichlorobiphenyl; 2,2’,3-Trichlorobiphenyl; 2,4’,6-Trichlorobiphenyl; 2,3’,5-Trichlorobiphenyl; 2,3’,4-Trichlorobiphenyl; 2,4’,5-Trichlorobiphenyl; 2,4,4’-Trichlorobiphenyl; 2’,3,4-Trichlorobiphenyl; 2,3,3’-Trichlorobiphenyl; 2,3,4-Trichlorobiphenyl; 2,3,4’-Trichlorobiphenyl; 3,4,4’-Trichlorobiphenyl; 2,2’,5,6’-Tetrachlorobiphenyl; 2,2’,4,6’-Tetrachlorobiphenyl; 2,2’,3,6-Tetrachlorobiphenyl; 2,2’,3,6’-Tetrachlorobiphenyl; 2,2’,5,5’-Tetrachlorobiphenyl; 2,3’,5’,6-Tetrachlorobiphenyl; 2,2’,4,5’-Tetrachlorobiphenyl; 2,2’,3,5-Tetrachlorobiphenyl; 2,2’4,4’-Tetrachlorobiphenyl; 2,2’,4,5-Tetrachlorobiphenyl; 2,4,4’,6-Tetrachlorobiphenyl; 2,2’,3,5’-Tetrachlorobiphenyl; 2,2’,3,4’-Tetrachlorobiphenyl; 2,3,3’,6-Tetrachlorobiphenyl; 2,2’,3,4-Tetrachlorobiphenyl; 2,3’,4’,6-Tetrachlorobiphenyl; 2,3,4’,6-Tetrachlorobiphenyl; 2,3’,4,5’-Tetrachlorobiphenyl; 2,2’,3,3’-Tetrachlorobiphenyl; 2,4,4’,5-Tetrachlorobiphenyl; 2,3,4,5-Tetrachlorobiphenyl; 2,3,3’,4’-Tetrachlorobiphenyl; 2,3,4,4’-Tetrachlorobiphenyl; 3,3’,4,4’-Tetrachlorobiphenyl; 2,2’,3,4’,6-Pentachlorobiphenyl; 2,2’,3,5,5’-Pentachlorobiphenyl; 2,2’,3,3’,6-Pentachlorobiphenyl; 2,2’,3,4’,5-Pentachlorobiphenyl;2,2’,4,5,5’-Pentachlorobiphenyl; 2,2’,3,4,6’-Pentachlorobiphenyl; 2,2’,4,4’,5-Pentachlorobiphenyl; 2,2’,3,3’,5-Pentachlorobiphenyl; 2,3,3’,4,5’-Pentachlorobiphenyl; 2,2’,3’,4,5-Pentachlorobiphenyl; 2,2’,3,4,5-Pentachlorobiphenyl; 2,2’,3,4,5’-Pentachlorobiphenyl; 2,3,4,4’,6-Pentachlorobiphenyl; 2,3,4,5,6-Pentachlorobiphenyl; 2,2’,3,4,4’-Pentachlorobiphenyl; 2,3’,4,5,5’-Pentachlorobiphenyl; 2,3,3’,4’,6-Pentachlorobiphenyl; 2,2’,3,3’,4-Pentachlorobiphenyl; 2,3,4,4’,5-Pentachlorobiphenyl; 2’,3,3’4,5-Pentachlorobiphenyl; 3,3’,4,4’,5-Pentachlorobiphenyl; 2,2’,3,3’,6,6’-Hexachlorobiphenyl; 2,2’,3,5,5’,6-Hexachlorobiphenyl; 2,2’,3,4,5’,6-Hexachlorobiphenyl; 2,2’,3,3’,5,6’-Hexachlorobiphenyl; 2,2’,3,4’,5’,6-Hexachlorobiphenyl; 2,2’,3,4,4’,6-Hexachlorobiphenyl; 2,2’,3,3’,5,6-Hexachlorobiphenyl; 2,2’,3,4,5,6’-Hexachlorobiphenyl; 2,2’,3,3’,4,6-Hexachlorobiphenyl; 2,2’,3,4,5,6-Hexachlorobiphenyl; 2,2’,3,4’,5,5’-Hexachlorobiphenyl; 2’,3,4,4’,5-Pentachlorobiphenyl; 2,3’,4,4’,5-Pentachlorobiphenyl; 2,3,3’,4,5-Pentachlorobiphenyl; 2,3,3’,4,4’-Pentachlorobiphenyl; 3,3’,4,5,5’-Pentachlorobiphenyl; 2,2’,4,4’,5,5’-Hexachlorobiphenyl; 2,2’,3,3’,4,6’-Hexachlorobiphenyl; 2,3’,4,4’,5’,6-Hexachlorobiphenyl; 2,2’,3,4,5,5’-Hexachlorobiphenyl; 2,2’,3,4,4’,5-Hexachlorobiphenyl; 2,2’,3,4,4’,5’-Hexachlorobiphenyl; 2,3,3’,4’,5,6-Hexachlorobiphenyl; 2,3,3’,4’,5’,6-Hexachlorobiphenyl; 2,3,3’,4,4’,6-Hexachlorobiphenyl; 2,3,3’,4,5,6-Hexachlorobiphenyl; 2,2’,3,3’,4,5-Hexachlorobiphenyl; 2,2’,3,3’,4,4’-Hexachlorobiphenyl; 2,3,3’,4,4’,5-Hexachlorobiphenyl; 2,3,3’,4,4’,5’-Hexachlorobiphenyl; 2,2’,3,3’,5,6,6’-Heptachlorobiphenyl; 2,2’,3,3’,4,6,6’-Heptachlorobiphenyl; 2,2’,3,3’,5,5’,6-Heptachlorobiphenyl;

2,2’,3,3’,4,5’,6-Heptachlorobiphenyl; 2,2’,3,4’,5,5’,6-Heptachlorobiphenyl; 2,2’,3,4,4’,5,6’-Heptachlorobiphenyl; 2,2’,3,4,4’,5’,6-Heptachlorobiphenyl; 2,2’,3,4,5,5’,6-Heptachlorobiphenyl; 2,2’,3,3’,4,5,6’-Heptachlorobiphenyl; 2,2’,3,4,4’,5,6-Heptachlorobiphenyl; 2,2’,3,3’,4’,5,6-Heptachlorobiphenyl; 2,2’,3,3’,4,4’,6-Heptachlorobiphenyl; 2,2’,3,3’,4,5,6-Heptachlorobiphenyl; 2,2’,3,3’,4,5,5’-Heptachlorobiphenyl; 2,3,3’,4,5,5’,6-Heptachlorobiphenyl; 2,2’,3,4,4’,5,5’-Heptachlorobiphenyl; 2,3,3’,4’,5,5’,6-Heptachlorobiphenyl; 2,2’,3,3’,4,4’,5-Heptachlorobiphenyl; 2,3,3’,4,4’,5,6-Heptachlorobiphenyl; 2,2’,3,3’,5,5’,6,6’-Octachlorobiphenyl; 2,2’,3,3’,4,5’,6,6’-Octachlorobiphenyl; 2,2’,3,3’,4,5,6,6’-Octachlorobiphenyl; 2,2’,3,3’,4,5,5’,6-Octachlorobiphenyl; 2,2’,3,3’,4,4’,5’,6-Octachlorobiphenyl; 2,2’,3,4,4’,5,5’,6-Octachlorobiphenyl; 2,2’,3,3’,4,4’,5,6-Octachlorobiphenyl; 2,2’,3,3’,4,4’,5,5’-Octachlorobiphenyl; 2,3,3’,4,4’,5,5’,6-Octachlorobiphenyl; 2,2’,3,3’,4,5,5’,6,6’-Nonachlorobiphenyl.

[2] PCBs bottom sediment include: Aroclor-1016, Aroclor-1221, Aroclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254, Aroclor-1260, Aroclor-1262, Aroclor-1268.

[3] PAHs include: Acenaphthene, Acenaphthylene, Anthracene, Benzo(a)anthracene, Benzo(b)fluoranthracene, Benzo(k)fluoranthene, Benzo(a)pyrene, Benzo(ghi)perylene, Chrysene, Bibenzo(a,h)anthracene, Fluoranthene, Fluorene, Indeno(1,2,3-cd)pyrene, Napthalene, Phenanthrene, Pyrene, biphenyl, 2-methyl napthalene.

[4] Pesticides include: Aldrin, alpha-BHC, beta-BHC, delta-BHC, gamma-BHC, Alpha Chlordane, Gamma Chlordane, Chlordane Technical, 4-4’-DDD, 4-4’-DDE, 4-4’-DDT, Dieldrin, Endosulfane I, Endosulfane II, Endosulfane sulfate, Endrin, Endrin aldehyde, Endrin ketone, Heptachlor, Heptachlor epoxide, Methoxychlor, Toxaphene.

Table 8. Field and Quality Control Sample Summary

[SOP, Standard Operating Procedure; PCB, polychlorinated biphenyls; EPH, Extractable petroleum hydrocarbons; PAH, polyaromatic hydrocarbons; No., Number; --, unknown]

Medium/ Matrix	Analyte	Concen-tration Level	Analytical Method/ SOP Reference	[1]No. of Loca-tions	Number of Replicates or Duplicates	No.of Equip-ment Blanks	No.of Perfor-mance sam-ples (PES)	Total No. of sam-ples
Water	PCBs	Low	Method 8082A	30	1 per 10 samples (3 Total)	0	0	33
Bottom sediment	PCBs	Low	EIA-PESTSOIL2.SOP	52	10 percent (5 Total)	2	1	60
Bottom sediment	EPH	Low	Method for the Determination of EPH	32	10 percent (3 Total)	2	0	37
Bottom sediment	PAHs	Low	PAHSOIL4.SOP	5	20 percent (1 Total)	2	1	9
Bottom sediment	Pesticides	Low	EIA-PESTSOIL2.SOP	52	10 percent (5 Total)	2	1	60
Bottom sediment	Aluminum, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Antimony, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Arsenic, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Barium, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Beryllium, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Bismuth, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Cadmium total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Calcium, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Chromium, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Cobalt, total	Low	200.8	52	10 percent (5 Total)	2	1	60

Table 8. Field and Quality Control Sample Summary

[SOP, Standard Operating Procedure; PCB, polychlorinated biphenyls; EPH, Extractable petroleum hydrocarbons; PAH, polyaromatic hydrocarbons; No., Number; --, unknown]

Medium/ Matrix	Analyte	Concen-tration Level	Analytical Method/ SOP Reference	[1]No. of Loca-tions	Number of Replicates or Duplicates	No.of Equip-ment Blanks	No.of Perfor-mance sam-ples (PES)	Total No. of sam-ples
Bottom sediment	Copper, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Iron, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Lanthanum, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Lead, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Magnesium, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Mercury, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Molybdenum, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Nickel, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Phosphorus, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Potassium, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Scandium, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Silver, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Sodium, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Strontium, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Tin, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Titanium, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Tungsten, total	Low	200.8	52	10 percent (5 Total)	2	1	60

Table 8. Field and Quality Control Sample Summary

[SOP, Standard Operating Procedure; PCB, polychlorinated biphenyls; EPH, Extractable petroleum hydrocarbons; PAH, polyaromatic hydrocarbons; No., Number; --, unknown]

Medium/ Matrix	Analyte	Concen-tration Level	Analytical Method/ SOP Reference	[1]No. of Loca-tions	Number of Replicates or Duplicates	No.of Equip-ment Blanks	No.of Perfor-mance sam-ples (PES)	Total No. of sam-ples
Bottom sediment	Vanadium, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Zinc, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Zirconium, total	Low	200.8	52	10 percent (5 Total)	2	1	60
Bottom sediment	Total Organic Carbon	Low	EIA-MISTOCZ.SOP	52	10 percent (5 Total)	2	0	57
Bottom sediment	Grain-size	NA	GRSIZ.SOP	52	10 percent (5 Total)	0	1	58

[1]Cores will be homogenized into one sample per location

Table 9. Analytical Services

[SOP, Standard Operating Procedure; PCB, polychlorinated biphenyls; EPH, Extractable petroleum hydrocarbons; PAH, polyaromatic hydrocarbons; USGS, U.S. Geological Survey]

Medium /Matrix	Analyte	Concen-tration Level	Analytical Method/ SOP Reference	Data Package Time	Laboratory/ Organization	Backup Laboratory Organization
Water	PCBs	Low	Method 8082A	30 days	Axys Analytical Services Ltd. P.O. Box 2219 2045 Mills Road West Sidney, British Columbia Canada V8L358 Phone: (250) 656-0881 www.axys.com/	Enviro-Test Laboratories 9936 - 67th Avenue Edmonton, Alberta Canada T6E 0P5 (780) 413-5227 www.envirotest.com/
Bottom sediment	PCBs	Low	EIA-PESTSOIL2.SOP	30 days	U.S. Environmental Protection Agency Region I Environmental Services Division 11 Technology Drive North Chelmsford, MA 01863-2431 (888) 372-7341, (617) 918-8300 www.epa.gov/ region1/about/lab/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	EPH	Low	See SOP	30 days	Alpha Analytical Labs Eight Walkup Drive Westborough, MA 01581-1019 (508) 898-9220 www.alphalab.com/ alphaweb/index.cfm	New England Testing Laboratory 1254 Douglas Avenue North Providence, Rhode Island 02904 1-888-8NETLAB www.newengland testing.com
Bottom sediment	PAHs	Low	PAHSOIL4. SOP	30 days	U.S. Environmental Protection Agency Region I Environmental Services Division 11 Technology Drive North Chelmsford, MA 01863-2431 (888) 372-7341, (617) 918-8300 www.epa.gov/ region1/about/lab/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/

Table 9. Analytical Services

[SOP, Standard Operating Procedure; PCB, polychlorinated biphenyls; EPH, Extractable petroleum hydrocarbons; PAH, polyaromatic hydrocarbons; USGS, U.S. Geological Survey]

Medium /Matrix	Analyte	Concen-tration Level	Analytical Method/ SOP Reference	Data Package Time	Laboratory/ Organization	Backup Laboratory Organization
Bottom sediment	Pesticides	Low	EIA-PESTSOIL2.SOP	30 days	U.S. Environmental Protection Agency Region I Environmental Services Division 11 Technology Drive North Chelmsford, MA 01863-2431 (888) 372-7341, (617) 918-8300 www.epa.gov/region1/about/lab/index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Aluminum, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Antimony, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Arsenic, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Barium, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/

Table 9. Analytical Services

[SOP, Standard Operating Procedure; PCB, polychlorinated biphenyls; EPH, Extractable petroleum hydrocarbons; PAH, polyaromatic hydrocarbons; USGS, U.S. Geological Survey]

Medium /Matrix	Analyte	Concen-tration Level	Analytical Method/ SOP Reference	Data Package Time	Laboratory/ Organization	Backup Laboratory Organization
Bottom sediment	Beryllium, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Bismuth, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Cadmium total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Calcium, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: 416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Chromium, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Cobalt, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/

Table 9. Analytical Services

[SOP, Standard Operating Procedure; PCB, polychlorinated biphenyls; EPH, Extractable petroleum hydrocarbons; PAH, polyaromatic hydrocarbons; USGS, U.S. Geological Survey]

Medium /Matrix	Analyte	Concen-tration Level	Analytical Method/ SOP Reference	Data Package Time	Laboratory/ Organization	Backup Laboratory Organization
Bottom sediment	Copper, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Iron, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Lanthanum, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Lead, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Magnesium, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Mercury, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/

Table 9. Analytical Services

[SOP, Standard Operating Procedure; PCB, polychlorinated biphenyls; EPH, Extractable petroleum hydrocarbons; PAH, polyaromatic hydrocarbons; USGS, U.S. Geological Survey]

Medium /Matrix	Analyte	Concen-tration Level	Analytical Method/ SOP Reference	Data Package Time	Laboratory/ Organization	Backup Laboratory Organization
Bottom sediment	Molybdenum, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Nickel, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Phosphorus, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Potassium, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Scandium, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Silver, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/

Table 9. Analytical Services

[SOP, Standard Operating Procedure; PCB, polychlorinated biphenyls; EPH, Extractable petroleum hydrocarbons; PAH, polyaromatic hydrocarbons; USGS, U.S. Geological Survey]

Medium /Matrix	Analyte	Concen-tration Level	Analytical Method/ SOP Reference	Data Package Time	Laboratory/ Organization	Backup Laboratory Organization
Bottom sediment	Sodium, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Strontium, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Tin, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Titanium, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Tungsten, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Vanadium, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/

Table 9. Analytical Services

[SOP, Standard Operating Procedure; PCB, polychlorinated biphenyls; EPH, Extractable petroleum hydrocarbons; PAH, polyaromatic hydrocarbons; USGS, U.S. Geological Survey]

Medium /Matrix	Analyte	Concen-tration Level	Analytical Method/ SOP Reference	Data Package Time	Laboratory/ Organization	Backup Laboratory Organization
Bottom sediment	Zinc, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Zirconium, total	Low	EPA 200.8 (analysis) EPA 3050B (digestion)	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Total organic carbon	Low	EIA-MISTOCZ .SOP	30 days	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada Phone: (416) 445-5755 www.sgs.ca/xral/ index.html	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/
Bottom sediment	Grain-size distribution	NA	GRSIZ.SOP	30 days	USGS Sediment Laboratory Federal Building, rm 269 400 South Clinton St. Iowa City, IA 52240 ia.water.usgs.gov/	National Water Quality Laboratory P.O. Box 25046, MS 407 Building 95 Denver Federal Center Denver, CO 80225-0046 (303) 236-2000 nwql.usgs.gov/

Project Schedule

Table 10. Project Schedule Timeline

[QAPP, Quality Assurance Project Plan; PCB, polychlorinated biphenyls; USGS, U.S. Geological Survey]

Activities	Antici-pated date of Initiation	Antici-pated Date of Comple-tion	Deliverable	Deliver-able Due Date
QAPP preparation	07/09/02	11/01/02	QAPP document	11/01/02
PCB sampling and analysis	08/01/02	12/01/02	PCB source identification	12/01/02
Sediment sampling and analysis	10/01/02	12/01/02	Sediment quality data	12/01/02
Ground penetrating radar collection and interpretation	11/01/02	12/01/02	Bathymetry and soft sediment thickness	12/01/02
Report preparation	12/01/02	02/01/03	Draft copy of the report summarizing findings	02/01/03
Report review	02/30/03	07/01/03	Review copy of the report summarizing findings	07/01/03
Report publication	07/01/03	07/01/03	USGS Water-Resources Investigations report summarizing findings	07/01/03

Project Quality Objectives and Measurement Performance Criteria

Project Quality Objectives

Data users:

- Massachusetts Executive Office of Environmental Affairs
- Massachusetts Department of Environmental Protection
- U.S. Environmental Protection Agency

Data usage: The results of this investigation will be used to guide appropriate actions with respect to management of sediment entrapped behind the Baker and Tilestone-Hollingsworth Dams that are being considered for removal.

Data type needed:

- Contaminants of Concern and Other Target Analytes (table 7)
- Data Acquisition Requirements (table 26)

Data quality:

- Measurement Performance Criteria (table 11)
- Field Sampling Equipment Calibration (table 14)
- Field Equipment Maintenance, Testing, and Inspection (table 15)
- Field Analytical Method and Standard Operating Procedure Reference (table 17)
- Field Analytical Instrument Calibration (table 18)
- Fixed Laboratory Analytical Methods and Standard Operating Procedure (table 21)
- Fixed Laboratory Instrument Calibration (table 22)
- Field Analytical Quality Control (table 24)

Amount of data needed: Field and Quality Control Sample Summary (table 8)

Data collection:

- Distribution List (table 2)
- Project Personnel Sign-Off Sheet (table 3)
- Personal Responsibilities and Qualifications (table 5)
- Special Personnel Training Requirements (table 6)
- Project Schedule Timetable (table 10)
- Project Sampling SOP Reference (table 13)
- Field Analytical Methods and Standard Operating Procedure Reference (table 17)
- Fixed Laboratory Analytical Methods and Standard Operating Procedures (table 21)

Records and reports: The number, format, and timing of project products will be determined in consultation with cooperators. We are planning an USGS Water-Resources Investigations Report documenting results.

Measurement Performance Criteria

The data quality objectives were chosen to support the following usage of the data (1) measure and map water depths and sediment thickness; (2) calculate water and sediment volumes; (3) determine physical and chemical characteristics of the bottom sediments (table 7); and (4) determine, where possible, specific sources of PCBs affecting the water-column and bottom sediments, using newly developed PCB fingerprinting techniques (See Colman, 2000).

- ***Bias:*** Bias will be determined quantitatively with the analysis of performance evaluation samples (or reference sediment) for laboratory analyzed constituents in table 7 for those constituents for which it is appropriate. Performance evaluation samples with known concentrations of the selected analytes will be analyzed to determine if the project quality objectives were met.
- ***Variability:*** Variability is the degree of agreement among repeated measurements of the same analyte under the same condition. Project variability caused by field activities (collection, processing, and preservation) will be measured by collecting quality control samples including [field split field samples (or replicates) and field concurrent replicates (or field duplicates)]. Variability specific to the laboratory will be measured by analyzing laboratory duplicate samples. Comparing overall project variability and laboratory variability will be completed to identify sources of imprecision during the sample collection, processing, and preservation and laboratory analysis of the samples.
- ***Representativeness:*** Data must be representative of conditions existing at the time of sample collection. Samples must be preserved immediately in accordance with protocol (table 12). Field and laboratory conditions that may affect sample integrity are to be documented on the field collection forms or laboratory logs. At least 80% of the data must be determined to be representative for the project to be considered complete.
- ***Data completeness:*** To ensure that the samples and field data were properly collected, all field information will be reviewed by the USGS-WRD, Marl borough, Massachusetts Data Management Group in accordance with District Data Management Policy DPD #3, MA-RI District Administration Memorandum No. 98.01 (U.S. Geological Survey, 1997). If data does not meet the 80% data completeness requirement, a meeting will be held with the U.S. Geological Survey Water-Quality Specialist (table 2) to determine an appropriate response, of which one response would be re-sampling of the questionable sample if feasible.

Table 11. Measurement Performance Criteria

[PES, Performance evaluation standards]

Analyte	Data Quality Indicators	Measurement Performance Criteria	QC Sample or Activity Used to asses Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both
Organic compounds (see table 9)	Bias	No false negatives, no false positives, all target compounds within quantitative warning limits	PES and Blanks	A
Organic compounds (see table 9)	Variability	Relative percent difference (RPD)	Laboratory Duplicates	A
Organic compounds (see table 9)	Variability	Relative percent difference (RPD)	Split field samples and concurrent replicates	SA
Trace elements (see table 9)	Bias	No false negatives, no false positives, all target compounds within quantitative warning limits	PES and Blanks	A
Trace elements (see table 9)	Variability	Relative percent difference (RPD)	Laboratory Duplicates	A
Trace elements (see table 9)	Variability	Relative percent difference (RPD)	Split field samples and concurrent replicates	SA
Grain-size distribution	Variability	Relative percent difference (RPD)	Laboratory Duplicates	A
Grain-size distribution	Variability	Relative percent difference (RPD)	Split field samples and concurrent replicates	SA
Grain-Size distribution	Bias	Within quantitative limits	PES	A

MEASUREMENT AND DATA AQUISITION ELEMENTS

Sample Process Design

Sampling Design Rationale

Restoration of anadromous fish to the Neponset River has been the subject of a study by the US Army Corps of Engineers, under authority provided by Section 206 of the Water Resources Development Act of 1996. The Massachusetts Executive Office of Environmental Affairs requested the Corps to undertake this study and a preliminary draft of the Ecological Restoration Report and Environmental Assessment, dated February 1, 2002, has been provided to EOEA for review and comment.One of the findings is the presence of organic compounds and trace elements in the sediments impounded behind both the Baker Dam and Tilestone-Hollingsworth Dam.

Table 12. Sampling Locations, Sampling, and Analysis Method and Standard Operating Procedure Requirements

[^{o}, degrees; C, Celsius; -, minus; L, liter]

Sample Location	Sample Medium	Analyte	Sample Volume	Containers	Preservation	Holding Time
Neponset River and Mother Brook	Water	Polychlorinated Biphenyls	0.25 Liter	I-Chem jars	Cool 4^{o}C (field) and -20 ^{o}C (Laboratory)	8 hours at 4^{o}C and indefinitely at -20 ^{o}C
Neponset River	Bottom sediment	Organic Compounds (table 7)	1 Liter per sample	Glass with Teflon lined caps (1L)	cool 4^{o}C	7 days to extraction and 40 days to analysis
Neponset River	Bottom sediment	Trace elements (table 7)	250 mL	Whirl Pack Bags	cool 4^{o}C	6 months
Neponset River	Bottom sediment	Grain-size distribution	500 mL	Whirl Pack Bags	cool 4^{o}C	NA

Sample Procedures and Requirements

Sampling Procedures

Table 13. Project Sampling Standard Operating Procedure Reference

Reference Number	Reference	Originating Organization	Equipment Identification	Modified for Project Work
S-01	Breault, R.F, Reisig, K. R., Barlow, L.K., and Weiskel, P.K., Distribution and potential for adverse biological effects of inorganic elements and organic compounds in bottom sediment, Lower Charles River, Massachusetts: U.S. Geological Survey Water-Resources Investigations report 00-4180, 70 p.	USGS	fathometer	N
S-02	**Modified from** Radtke, D.B., ed., 1997, Bottom-sediment samples, in Wilde, F.W., Radtke, D.B., Gibs, Jacob, and Iwatsubo, R.T., eds., National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A8, variously paged.	USGS	Eckman dredge/ piston corer	Y Stainless-steel was used in lieu of non-metallic sampling and processing equipment.
S-03	Colman, J.A., 2000, Source identification and fish exposure for polychlorinated biphenyls using congener analysis from passive water samplers in the Millers River Basin, Massachusetts: U.S. Geological Survey Water-Resources Investigations Report 00-4250, 44 p.	USGS	passive samplers	N
S-04	Versteeg, Roelof, White, E.A., and Rittger, Karl, 2001, Ground-penetrating radar and swept-frequency seismic imaging of shallow water sediments in the Hudson River: *in* Symposium on the Application of Geophysics to Engineering and Environmental Problems, Denver, Colorado, March 4-7, 2001, Proceedings: Wheat Ridge, Colo., Environmental and Engineering Geophysical Society, CD-ROM.	USGS	ground penetrating radar	N

Sampling Standard Operating Procedure Modifications

If any of the sampling SOPs are modified to meet the projects quality objectives, then the described modification(s) will be documented and submitted for approval in the same manner as the original QAPP in accordance with USEPA (1998). Project personnel listed in table 4 are authorized to initiate procedural modification the original QAPP. All amendments or changes to the original QAPP (Document Control Number USGS442519400) will be immediately incorporated into the final version of the QAPP, which will be maintained by the U.S. Geological Survey as a part of the official project file in accordance with MA-RI District Admin. Memo. No. 98.01 District Data Management Policy (U.S. Geological Survey, 1997).

Cleaning and Decontamination of Equipment and Sample Containers

USGS policy requires that sampling equipment be properly cleaned before contacting the sample and that the effectiveness of cleaning procedures be quality controlled. The goal of equipment cleaning is to help ensure that the equipment is not a source of foreign substances that could affect the ambient concentrations or chemistry of target analytes in the sample. Sediment and PCB sampling equipment cleaning procedures are in described in detail by Radtke (1997) and Colman (2000), respectively.

Field Equipment Calibration

Table 14. Field Sampling Equipment Calibration

[NA, not applicable; CA, Corrective Action]

Equipment	Appen-dix	Frequency of Calibra-tion	Acceptance Criteria	Corrective Action	Persons Responsi-ble for CA	SOP
NA	NA	NA	NA	NA	NA	NA

Field Equipment Maintenance, Testing, and Inspection Requirements

Table 15. Field Equipment Maintenance, Testing, and Inspection

Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Responsible Person(s)	Frequency of Calibration	Acceptance Criteria	Corrective Action	SOP
Fathometer	General Maintenance	Operation	Self Test	Robert Breault, Jason Sorenson	Prior to use	Pass	Re-perform self test	S-01
Ground Penetrating Radar	General Maintenance	Operation	Self Test	Robert Breault, Jason Sorenson	Prior to use	Pass	Re-perform self test	S-04

Inspection and Acceptance Requirements for Supplies and Sample Containers

Table 16. Inspection and Acceptance Requirements for Supplies/Sample Containers

Supplies	Supplier	Comments
Piston corer	U.S. Geological Survey	Piston corers are cleaned in accordance with Radtke (1997) and stored in plastic bags.
I-Chem sample bottles	Fisher Scientific	Bottles include full laboratory certification. They are certified for specific applications to meet U.S. EPA analyte specifications i-chem.nalgenunc.com/select/certification/certification.html accessed on September 17, 2002.
Low density polyethylene membranes and Viton O-rings	U.S. Geological Survey	Cleaned by 7-hour soxhlet extraction with hexane
Sediment sample bottles	Fisher Scientific	Bottles include full laboratory certification. They are certified for specific applications to meet U.S. EPA analyte specifications. i-chem.nalgenunc.com/select/certification/certification.html accessed on September 17, 2002.

Sample Handling, Tracking, and Custody Requirements

Sample Collection Documentation

Each sample bottle must be correctly labeled with the station identification number, date, time, and sample designation in accordance with Wilde and others (1999).

<u>Field Notes</u>

District policy of the Massachusetts-Rhode Island District of the USGS requires the use of standardized field notes to record field data as described in Quality-Assurance Plan for Water-Quality Activities in the Massachusetts-Rhode Island District Water Resources Division U. S. Geological Survey (DeSimone, 2002). Briefly, field notes will include at a minimum the following information,

- project number
- site name
- site number
- date and time of work
- site condition
- persons performing work
- reasons for work
- weather conditions
- instrumentation
- procedure and methods of collection
- type of data collected
- data base parameter codes.

<u>Field Documentation Management System</u>

Field notes will be completed on-site at the time sampling occurs. Notes will be written in a bound notebook that will be maintained by field personnel to record sample collection information. Field notes are archived indefinitely by the USGS office in Northborough, Massachusetts. Each sample sent to an analytical laboratory will include a completed chain-of–custody form which includes sample identification information. Copies of these forms will be kept at the USGS for data management purposes. After samples have been analyzed, laboratory record sheets are maintained in the USGS

Northborough office for ten years and then archived at the Federal Archives and Records Center, Waltham, Massachusetts. Paper copies of all data as well as computer back-up disks are maintained by the USGS.

Calibration and performance records substantiate the quality of data collected by documenting information about the calibration, performance, maintenance, upgrades, and custody of field instrumentation used for hydraulic investigations. Calibration and performance records will be kept for each piece of equipment used by the project as described in Quality-Assurance Plan for Water-Quality Activities in the Massachusetts-Rhode Island District Water Resources Division U. S. Geological Survey (DeSimone, 2002).

Sample Handling and Tracking System

Samples will be packaged and shipped or hand delivered to the laboratory (table 9) for analysis as soon as possible after collection. Protocols for labeling, documenting, and packaging samples will be in accordance with Wilde and others (1999).

Sample Custody

A chain-of-custody form will be used to document the types and numbers of samples collected and logged. Chain-of custody forms will include the following information;

- sample number
- sample location or identifier
- date and time of collection
- sampling personnel

The storage coolers will be taped with signed chain-of-custody tape while the samples are being stored. Samples sent to both the analytical laboratories will be identified using internal laboratory sample tracking numbers in accordance with each laboratory’s sample tracking procedures. Internal laboratory sample tracking numbers will be cross-referenced with the sample number assigned in the field.

Field Analytical Methods Requirements

Field Analytical Methods and Standard Operating Procedure Reference

Table 17. Field Analytical Methods and Standard Operating Procedure Reference

[NA, not applicable]

Reference Number	Appendix Number	Definitive or Screening Data	Originating Organization	Analytical Parameter	Instrument	Organiza-tion	Modified for Project Work
NA	NA	NA	NA	NA	NA	NA	NA

Field Analytical Methods and Standard Operating Procedure Modifications

If any of the field analytical method SOPs are modified to meet the projects quality objectives, then the described modification(s) will be documented and submitted for approval in the same manner as the original QAPP. Project personnel listed in table 4 are authorized to initiate procedural modification the original QAPP. All amendments or changes to the original QAPP (Document Control Number USGS442519400) will be immediately incorporated into the final version of the QAPP, which will be maintained by the U.S. Geological Survey as a part of the official project files as described in MA-RI District Admin. Memo. No. 98.01 District Data Management Policy (U.S. Geological Survey, 1997).

Field Analytical Instrument Calibration

Table 18. Field Analytical Instrument Calibration

[NA, not applicable; SOP, standard operating procedure]

Instrument	Frequency	Acceptance Criteria	Corrective Action	Persons Responsible	SOP
NA	NA	NA	NA	NA	NA

Field Analytical Instrument and Equipment Maintenance, Testing, and Inspection Requirements

Table 19. Field Analytical Instrument and Equipment Maintenance, Testing and Inspection

[NA, not applicable; SOP, standard operating procedure]

Instrument	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Persons Responsible	Method/ SOP
NA	NA	NA	NA	NA	NA	NA	NA

Field Analytical Inspection and Acceptance Requirements for Supplies

Table 20. Field Analytical Inspection and Acceptance Requirements For Supplies

[NA, not applicable]

Supplies	Vendor	Comments
NA	NA	NA

Fixed Laboratory Analytical Method Requirements

Fixed Laboratory Analytical Methods and Standard Operating Procedures

Table 21. Fixed Laboratory Analytical Methods and Standard Operating Procedures

[SOP, standard operating procedure; PCB, polychlorinated biphenyls; Y, yes; N, no; ICP, inductively coupled plasma]

Reference No.	Laboratory/ Organization	Analytical Method/ SOP Reference	Definitive or Screening	Analyte	Instrument	Modified for Project
L-01	Axys Analytical Services Ltd. 2045 Mills Road West Sidney, British Columbia Canada, V8L358 (250) 656-0881	Method 8082A	Definitive	PCBs, whole water	Gas chromatography with low-resolution quadupole mas selective detection	Y
L-02	U.S. Environmental Protection Agency Region I Environmental Services Division 11 Technology Drive North Chelmsford, MA 01863-2431 (888) 372-7341, (617) 918-8300	EIA-PESTSOIL2.SOP	Definitive	PCBs, bottom sediment	Gas chromatography with electron capture	N
L-03	Alpha Analytical Labs Eight Walkup Drive Westborough, MA 01581-1019 (508) 898-9220	Method for the Determination of EPH	Definitive	EPH, bottom sediment	Infrared spectroscopy	N
L-04	U.S. Environmental Protection Agency Region I Environmental Services Division 11 Technology Drive North Chelmsford, MA 01863-2431 (888) 372-7341, (617) 918-8300	PAHSOIL4.SOP	Definitive	PAHs, bottom sediment	Gas chromatography mass spectrometry	N
L-05	U.S. Environmental Protection Agency Region I Environmental Services Division 11 Technology Drive North Chelmsford, MA 01863-2431 (888) 372-7341, (617) 918-8300	EIA-PESTSOIL2.SOP	Definitive	Pesticides, bottom sediment	Gas chromatography -electron capture	N

Table 21. Fixed Laboratory Analytical Methods and Standard Operating Procedures

[SOP, standard operating procedure; PCB, polychlorinated biphenyls; Y, yes; N, no; ICP, inductively coupled plasma]

Reference No.	Laboratory/ Organization	Analytical Method/ SOP Reference	Definitive or Screening	Analyte	Instrument	Modified for Project
L-06	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Aluminum, total	ICP emission spectroscopy	N
L-07	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Antimony, total	ICP emission spectroscopy	N
L-08	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Arsenic, total	ICP emission spectroscopy	N
L-09	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Barium, total	ICP emission spectroscopy	N
L-10	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Beryllium, total	ICP emission spectroscopy	N
L-11	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Bismuth, total	ICP emission spectroscopy	N
L-12	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Cadmium total	ICP emission spectroscopy	N
L-13	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Calcium, total	ICP emission spectroscopy	N
L-14	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Chromium, total	ICP emission spectroscopy	N
L-15	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Cobalt, total	ICP emission spectroscopy	N

Table 21. Fixed Laboratory Analytical Methods and Standard Operating Procedures

[SOP, standard operating procedure; PCB, polychlorinated biphenyls; Y, yes; N, no; ICP, inductively coupled plasma]

Reference No.	Laboratory/ Organization	Analytical Method/ SOP Reference	Definitive or Screening	Analyte	Instrument	Modified for Project
L-16	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Copper, total	ICP emission spectroscopy	N
L-17	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Iron, total	ICP emission spectroscopy	N
L-18	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Lanthanum, total	ICP emission spectroscopy	N
L-19	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Lead, total	ICP emission spectroscopy	N
L-20	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Magnesium, total	ICP emission spectroscopy	N
L-21	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Mercury, total	ICP emission spectroscopy	N
L-22	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Molybdenum, total	ICP emission spectroscopy	N
L-23	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Nickel, total	ICP emission spectroscopy	N
L-24	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Phosphorus, total	ICP emission spectroscopy	N
L-25	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Potassium, total	ICP emission spectroscopy	N

Table 21. Fixed Laboratory Analytical Methods and Standard Operating Procedures

[SOP, standard operating procedure; PCB, polychlorinated biphenyls; Y, yes; N, no; ICP, inductively coupled plasma]

Reference No.	Laboratory/ Organization	Analytical Method/ SOP Reference	Definitive or Screening	Analyte	Instrument	Modified for Project
L-26	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Scandium, total	ICP emission spectroscopy	N
L-27	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Silver, total	ICP emission spectroscopy	N
L-28	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Sodium, total	ICP emission spectroscopy	N
L-29	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Strontium, total	ICP emission spectroscopy	N
L-30	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Tin, total	ICP emission spectroscopy	N
L-31	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Titanium, total	ICP emission spectroscopy	N
L-32	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Tungsten, total	ICP emission spectroscopy	N
L-33	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Vanadium, total	ICP emission spectroscopy	N
L-34	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Zinc, total	ICP emission spectroscopy	N
L-35	XRAL Laboratories 1885 Leslie St. Toronto, ON M3B 3J4, Canada (416) 445-5755	200.8	Definitive	Zirconium, total	ICP emission spectroscopy	N

Table 21. Fixed Laboratory Analytical Methods and Standard Operating Procedures

[SOP, standard operating procedure; PCB, polychlorinated biphenyls; Y, yes; N, no; ICP, inductively coupled plasma]

Reference No.	Laboratory/ Organization	Analytical Method/ SOP Reference	Definitive or Screening	Analyte	Instrument	Modified for Project
L-36	USGS Sediment Laboratory Federal Building, rm 269 400 South Clinton St.Iowa City, IA 52240 319-358-3602	GRSIZ.SOP	Definitive	Grain-size distribution	Sieving	N

Fixed Laboratory Analytical Method and Standard Operating Procedure Modifications

If any of the fixed laboratory analytical method SOPs are modified to meet the projects quality objectives, then the described modification(s) will be documented and submitted for approval in the same manner as the original QAPP. Project personnel listed in table 4 are authorized to initiate procedural modification the original QAPP. All amendments or changes to the original QAPP (Document Control Number USGS442519400) will be immediately incorporated into the final version of the QAPP, which will be maintained by the U.S. Geological Survey as a part of the official project file in accordance with MA-RI District Admin. Memo. No. 98.01 District Data Management Policy (U.S. Geological Survey, 1997).

Fixed Laboratory Instrument Calibration

Table 22. Fixed Laboratory Instrument Calibration

[SOP, standard operating procedure; PCB, polychlorinated biphenyls; ICP, inductively coupled plasma; No., number]

Instrument	Activity.	Maintenance, Testing, and Inspection Activities, Frequency, Accepted criteria, corrective action	Person Responsible	Refer-ence No.
Gas chromatography with low-resolution quadupole mas selective detection	PCBs, whole water	As per SOP	Georgina Brook	L-01
Gas chromatography with electron capture	PCBs, bottom sediment	As per SOP	Peter Philbrook	L-02
Infrared spectroscopy	EPH	As per SOP	Ellen Collins	L-03
Gas chromatography mass spectrometry	PAHs	As per SOP	Dan Boudreau	L-04
Gas chromatography with electron capture	Pesticides	As per SOP	Peter Philbrook	L-05
ICP emission spectroscopy	Aluminum, total	As per SOP	Dr. Hugh de Souza	L-06
ICP emission spectroscopy	Antimony, total	As per SOP	Dr. Hugh de Souza	L-07
ICP emission spectroscopy	Arsenic, total	As per SOP	Dr. Hugh de Souza	L-08

Table 22. Fixed Laboratory Instrument Calibration

[SOP, standard operating procedure; PCB, polychlorinated biphenyls; ICP, inductively coupled plasma; No., number]

Instrument	Activity.	Maintenance, Testing, and Inspection Activities, Frequency, Accepted criteria, corrective action	Person Responsible	Refer-ence No.
ICP emission spectroscopy	Barium, total	As per SOP	Dr. Hugh de Souza	L-09
ICP emission spectroscopy	Beryllium, total	As per SOP	Dr. Hugh de Souza	L-10
ICP emission spectroscopy	Bismuth, total	As per SOP	Dr. Hugh de Souza	L-11
ICP emission spectroscopy	Cadmium total	As per SOP	Dr. Hugh de Souza	L-12
ICP emission spectroscopy	Calcium, total	As per SOP	Dr. Hugh de Souza	L-13
ICP emission spectroscopy	Chromium, total	As per SOP	Dr. Hugh de Souza	L-14
ICP emission spectroscopy	Cobalt, total	As per SOP	Dr. Hugh de Souza	L-15
ICP emission spectroscopy	Copper, total	As per SOP	Dr. Hugh de Souza	L-16
ICP emission spectroscopy	Iron, total	As per SOP	Dr. Hugh de Souza	L-17
ICP emission spectroscopy	Lanthanum, total	As per SOP	Dr. Hugh de Souza	L-18
ICP emission spectroscopy	Lead, total	As per SOP	Dr. Hugh de Souza	L-19
ICP emission spectroscopy	Magnesium, total	As per SOP	Dr. Hugh de Souza	L-20
ICP emission spectroscopy	Mercury, total	As per SOP	Dr. Hugh de Souza	L-21
ICP emission spectroscopy	Molybdenum, total	As per SOP	Dr. Hugh de Souza	L-22
ICP emission spectroscopy	Nickel, total	As per SOP	Dr. Hugh de Souza	L-23
ICP emission spectroscopy	Phosphorus, total	As per SOP	Dr. Hugh de Souza	L-24
ICP emission spectroscopy	Potassium, total	As per SOP	Dr. Hugh de Souza	L-25

Table 22. Fixed Laboratory Instrument Calibration

[SOP, standard operating procedure; PCB, polychlorinated biphenyls; ICP, inductively coupled plasma; No., number]

Instrument	Activity.	Maintenance, Testing, and Inspection Activities, Frequency, Accepted criteria, corrective action	Person Responsible	Refer-ence No.
ICP emission spectroscopy	Scandium, total	As per SOP	Dr. Hugh de Souza	L-26
ICP emission spectroscopy	Silver, total	As per SOP	Dr. Hugh de Souza	L-27
ICP emission spectroscopy	Sodium, total	As per SOP	Dr. Hugh de Souza	L-28
ICP emission spectroscopy	Strontium, total	As per SOP	Dr. Hugh de Souza	L-29
ICP emission spectroscopy	Tin, total	As per SOP	Dr. Hugh de Souza	L-30
ICP emission spectroscopy	Titanium, total	As per SOP	Dr. Hugh de Souza	L-31
ICP emission spectroscopy	Tungsten, total	As per SOP	Dr. Hugh de Souza	L-32
ICP emission spectroscopy	Vanadium, total	As per SOP	Dr. Hugh de Souza	L-33
ICP emission spectroscopy	Zinc, total	As per SOP	Dr. Hugh de Souza	L-34
ICP emission spectroscopy	Zirconium, total	As per SOP	Dr. Hugh de Souza	L-35
Sieving	Grain-size distribution	As per SOP	Elizabeth Shreve	L-36

Fixed Laboratory Instrument and Equipment Maintenance, Testing and Inspection Requirements

Equipment maintenance logs must be kept and equipment must be checked prior to use. Laboratory instrument maintenance and inspection for the analytical laboratories will be in accordance with their Quality Assurance Management Plans.

Fixed Laboratory Inspection and Acceptance Requirements For Supplies

Procedures and activities to (1) ensure that all supplies used by the analytical laboratories are available and free from contaminants of concern (table 7), other target compounds, and interferences and (2) to otherwise ensure supply cleanliness and reagent purity, as well as corrective action procedures employed to prevent the use of unacceptable supplies, are described in laboratory quality assurance management plans.

Quality Control Requirements

Sample Quality Control

Table 23. Sample Quality Control

[USGS, U.S. Geological Survey]

Field QC	Frequency	Corrective Action	Persons Responsible	Data Quality Indicator	Measurement Performance Criteria
Split field sample (or replicates)	1 per 10 samples	Reclean, retest, resample, and/or qualify data	Field personnel (table 22)	Field and laboratory variability	Relative Percent difference less than 50 percent
Concurrent replicate sample (or field duplicates)	1 per 10 samples	Reclean, retest, resample, and/or qualify data	Field personnel (table 22)	Field and laboratory variability	Relative Percent difference less than 50 percent
Laboratory duplicate samples	1 per analytical run	Reclean, retest, resample, and/or qualify data	Lab Manager (table 22)	Laboratory variability	See table 25
Performance evaluation sample	1 per group (for example PCBs)	Reclean, retest, resample, and/or qualify data	Lab Manager (table 22)	Bias	No false negatives, no false positives, all target compounds within quantitative warning limits. See appendices 33 and 34

Analytical Quality Control

Field Analytical Quality Control

Table 24. Field Analytical Quality Control

[NA, not applicable]

Field QC	Frequency	Method/ SOP	Persons Responsible	Data Quality Indicator	Corrective Action	Measurement Performance Criteria
NA	NA	NA	NA	NA	NA	NA

Fixed Laboratory Quality Control

Table 25a. Analytical Quality Control: PCBs in water

[SOP, Standard operating procedure; CA, corrective action; QC, Quality control; EPA, Environmental protection agency; <. less than value shown; con., concentration; NA, not applicable; RPD, relative percent difference]

Laboratory QC:	Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsi-ble for CA	Data Quality Objective	Measurement Performance Criteria
Medium/Matrix		Hexane				
Sampling SOP		S-03				
Analytical Parameter		PCB Congeners				
Concentration Level		Low				
Analytical Method/SOP		1668				
Laboratory Name		AXYS Analytical				
Number of Sample Locations		30				
Laboratory QC:	**Frequency**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsi-ble for CA**	**Data Quality Objective**	**Measurement Performance Criteria**
MDL	Annually or when there is a change in the method or instrument	< 1/3 the regulatory compliance level or 1/3 lower than the EMDL in EPA method 1668	Recalibrate instrument and continue	Georgina Brook	Precision	< 1/3 the regulatory compliance level or 1/3 lower than the EMDL in EPA Method 1668
Method Blank	Initially with each sample batch	< 1/3 the regulatory compliance level or 1/3 lower than the EMDL in EPA Method 1668	If method blank contamination persists, the analysis is halted until the source of contamination is found.	Georgina Brook	Bias	Method blank results must fall below concentrations specific by the analytical method

Table 25a. Analytical Quality Control: PCBs in water

[SOP, Standard operating procedure; CA, corrective action; QC, Quality control; EPA, Environmental protection agency; <. less than value shown; con., concentration; NA, not applicable; RPD, relative percent difference]

Laboratory QC:	Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsi-ble for CA	Data Quality Objective	Measurement Performance Criteria
Surrogates	Every sample and blank	Labeled toxics/LOC/window-defining standard spiking solution 50-150 percent 50-140 percent 25-150 percent 30-135 percent *See Table 6 in SOP*	Preform additional cleanup, or dilute samples and retest	Georgina Brook	Accuracy	Labeled toxics/LOC/window-defining standard spiking solution 50-150 percent 50-140 percent 25-150 percent 30-135 percent *See Table 6 in SOP*
Matrix Spike	For low solid samples	Labeled NativeToxics/ LOC/window-defining standard spiking solution Within required precision limits defined by RPD (40-50 percent) *See Table 6 in SOP*	Preform additional cleanup, or dilute samples and retest	Georgina Brook	Accuracy	Labeled NativeToxics/ LOC/window-defining standard spiking solution Within required precision limits defined by RPD (40-50 percent) *See Table 6 in SOP*
Reagent Blank	NA	NA	NA	NA	NA	NA
Storage Blank	NA	NA	NA	NA	NA	NA
Reference samples or performance standard	Quarterly	No false negatives, no false positives, all target compounds within quantitative warning limits	Qualify data and direct laboratory to investigate problem	Georgina Brook	Accuracy and bias	No false negatives, no false positives, all target compounds within quantitative warning limits
Continuous Calibration (m/z ratios)	At the beginning of each 12-hr. shift which analyses are preformed	The m/z ratios for all congeners must be within limits. *See table 8 in SOP*	Adjust mass spectrometer until the m/z ratios fall within the limits specified	Georgina Brook	Accuracy	The m/z ratios for all congeners must be within limits. *See table 8 in SOP*
Continuous Calibration (GC peak)	At the beginning of each 12-hr. shift which analyses are preformed	The GC peak representing each congener in the verification standard must be present with a S/N of at least 10	Adjust mass spectrometer	Georgina Brook	Accuracy	The GC peak representing each congener in the verification standard must be present with a S/N of at least 10

Table 25a. Analytical Quality Control: PCBs in water

[SOP, Standard operating procedure; CA, corrective action; QC, Quality control; EPA, Environmental protection agency; <. less than value shown; con., concentration; NA, not applicable; RPD, relative percent difference]

Laboratory QC:	Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsi-ble for CA	Data Quality Objective	Measurement Performance Criteria
Continuous Calibration (Con.)	At the beginning of each 12-hr shift which analyses are preformed	Concentrations must be within the calibration verification limits *See table 6 of SOP*	Prepare fresh calibration standard or correct the problem and retest	Georgina Brook	Accuracy	Concentrations must be within the calibration verification limits *See table 6 of SOP*
Retention times (absolute and relative)	At the beginning of each 12-hr shift which analyses are preformed	**Absolute**: within 30 seconds of the retention times in the calibration **Relative:** within their respective retention time limits *See table 2 in SOP*	Adjust GC and repeat the verification test or re calibrate, or replace the GC column and verify calibration or re calibrate	Georgina Brook	Accuracy	**Absolute**: within 30 seconds of the retention times in the calibration **Relative:** within their respective retention time limits *See table 2 in SOP*

Table 25b. Analytical Quality Control: Elements in sediment

[SOP, Standard operating procedure; CA, corrective action; QC, Quality control; NA, not applicable; RPD, relative percent difference]

Laboratory QC:	Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for CA	Data Quality Objective	Measurement Performance Criteria
Medium/Matrix		Sediment				
Sampling SOP		S-02				
Analytical Parameter		Elements				
Concentration Level		Low				
Analytical Method/SOP		200.8				
Laboratory Name		XRAL Laboratories				
Number of Sample Locations		52				
Laboratory QC:	**Frequency**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for CA**	**Data Quality Objective**	**Measurement Performance Criteria**
Continual Calibration and/or Calibration Verification Checks	Run prior to the samples	Must meet the method specifications	Do not proceed until acceptable value obtained	Dr. Hugh de Souza	Accuracy	See SOPs
Method Blank	1 per 20 samples	No Target compounds greater than quantification level	Do not proceed until acceptable value obtained	Dr. Hugh de Souza	Bias	No Target compounds greater than quantification level
Laboratory Duplicates	1 per 12 samples	Within required precision limits defined by RPD (10 percent)	Do not proceed until acceptable value obtained	Dr. Hugh de Souza	Variability	Within required precision limits defined by RPD (10 percent)
Matrix Spike	1 per 20 samples	Within required precision limits defined by RPD (10 percent)	Do not proceed until acceptable value obtained	Dr. Hugh de Souza	Bias	Within required precision limits defined by RPD (10 percent)

Table 25b. Analytical Quality Control: Elements in sediment

[SOP, Standard operating procedure; CA, corrective action; QC, Quality control; NA, not applicable; RPD, relative percent difference]

Laboratory QC:	Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for CA	Data Quality Objective	Measurement Performance Criteria
Martrix Spike Duplicates	1 per 20 samples	Within required precision limits defined by RPD (10 percent)	Do not proceed until acceptable blank obtained	Dr. Hugh de Souza	Precision	Within required precision limits defined by statistical analysis
Matrix Spike-Recovery	1 per 20 samples	50-100 percent	Do not proceed until acceptable value obtained	Dr. Hugh de Souza	Accuracy and bias	50-100 percent
Reagent Blank	NA	NA	NA	NA	NA	NA
Storage Blank	NA	NA	NA	NA	NA	NA
Performance evaluation samples	Occasionally	No false negatives, no false positives, all target compounds within quantitative warning limits	Affected results are identified and samples reanalyzed of corrected for bias	Dr. Hugh de Souza	Bias and Sensitivity	No false negatives, no false positives, all target compounds within quantitative warning limits

Table 25c. Analytical Quality Control: Organochlorine pesticides in sediment

[SOP, Standard operating procedure; CA, corrective action; QC, Quality control; NA, not applicable; RPD, relative percent difference; ≥ less than or equal to the value shown]

Laboratory QC:	Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for CA	Data Quality Objective	Measurement Performance Criteria

Medium/Matrix	Sediment
Sampling SOP	S-02
Analytical Parameter	Organochlorine Pesticides/PCBs
Concentration Level	Low
Analytical Method/SOP	EIA-PESTSOIL2.SOP
Laboratory Name	USEPA
Number of Sample Locations	52

Laboratory QC:	Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for CA	Data Quality Objective	Measurement Performance Criteria
Initial Calibration	Run prior to the samples	$R^2 \geq 0.990$	Evaluate chromatogram, reintegrate, or re-calibrate	Peter Philbrook	Accuracy	$R^2 \geq 0.990$
Secondary Standard	Each new standard prepared	within 85 - 115 percent recovery of the accepted values	Evaluate chromatogram, reintegrate, or prepare new standards	Peter Philbrook	Accuracy	within 85 - 115 percent recovery of the accepted values
Continuous Calibration	Before sample analysis, every 8 hrs, and at end	< 15 percent difference from the initial calibration	Evaluate chromatogram, reintegrate, or re calibrate and reanalyze samples from the last valid cont. cal	Peter Philbrook	Precision	< 15 percent difference from the initial calibration
Method Blank	Before sample analysis, every 12 hrs, and at end	< quantitation limits	Check samples, check solvent and glassware	Peter Philbrook	Bias	< quantitation limits
Reagent Blank	NA	NA	NA	NA	NA	NA

Table 25c. Analytical Quality Control: Organochlorine pesticides in sediment

[SOP, Standard operating procedure; CA, corrective action; QC, Quality control; NA, not applicable; RPD, relative percent difference; ≥ less than or equal to the value shown]

Laboratory QC:	Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for CA	Data Quality Objective	Measurement Performance Criteria
Storage Blank	NA	NA	NA	NA	NA	NA
Instrument Blank	Before sample analysis, every 12 hrs, and at end	< ½ quantitation limits	Bake System	Peter Philbrook	Bias	< ½ quantitation limits
Laboratory Duplicate	5 percent of total samples	< 50 percent relative percent difference	Check the MS/MSD data, repeat duplicate if enough sample	Peter Philbrook	Precision	< 50 percent relative percent difference
Laboratory matrix spike	5 percent of total samples	Aldrin 30-137 percent gamma-BHC 20-129 percent 4,4'-DDT 40-163 percent Dieldrin 22-158 percent Endrin 1-190 percent Heptachlor 41-152 percent Arochlor 1221-1260 77-136 percent	Evaluate chromatogram, reintegrate, determine if interference exists rerun sample	Peter Philbrook	Accuracy	Aldrin 30-137 percent gamma-BHC 20-129 percent 4,4'-DDT 40-163 percent Dieldrin 22-158 percent Endrin 1-190 percent Heptachlor 41-152 percent Arochlor 1221-1260 77-136 percent
Matrix spike duplicates	5 percent of total samples	Aldrin <43percent gamma-BHC <50 percent 4,4'-DDT <50 percent Dieldrin <38 percent Endrin <45percent Heptachlor <31 percent Arochlor 1221-1260 <50 percent	Evaluate chromatogram, reintegrate, or rerun sample	Peter Philbrook	Precision	Aldrin <43 percent gamma-BHC <50 percent 4,4'-DDT <50 percent Dieldrin <38 percent Endrin <45 percent Heptachlor <31 percent Arochlor 1221-1260 <50 percent
LCS	NA	NA	NA	NA	NA	NA

Table 25c. Analytical Quality Control: Organochlorine pesticides in sediment

[SOP, Standard operating procedure; CA, corrective action; QC, Quality control; NA, not applicable; RPD, relative percent difference; ≥ less than or equal to the value shown]

Laboratory QC:	Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for CA	Data Quality Objective	Measurement Performance Criteria
LFB	When the is insufficient sample for MS/MSD	Aldrin 30-137 percent gamma-BHC 20-129 percent 4,4'-DDT 40-163 percent Dieldrin 22-158 percent Endrin 1-190 percent Heptachlor 41-152 percent	Evaluate chromatogram, reintegrate, determine if interference exists rerun sample	Peter Philbrook	Accuracy	Aldrin 30-137 percent gamma-BHC 20-129 percent 4,4'-DDT 40-163 percent Dieldrin 22-158 percent Endrin 1-190 percent Heptachlor 41-152 percent
Surrogates	Every Sample	Tetrachloroxylene 18-130 percent Decachlorobiphenyl 64-122 percent	Evaluate chromatogram and integrate, check blank recovery, rerun sample	Peter Philbrook	Accuracy	Tetrachloroxylene 18-130 percent Decachlorobiphenyl 64-122 percent
MDL	Annually or when there is a change in the method or instrument	< 5 ug/kg for single component pesticides and < 100 ug/kg for technical chlordane, toxaphene, and PCBs	Evaluate chromatogram and integrate, repeat study	Peter Philbrook	Precision	< 5 ug/kg for single component pesticides and < 100 ug/kg for technical Chlordane, Toxaphene, and PCBs
IDC	Change in the method or instrument	70 - 130 percent recovery for all analytes	Repeat IDC, prepare new standards	Peter Philbrook	Accuracy	70 - 130 percent recovery for all analytes

Table 25d. Analytical Quality Control: Polyaromatic Hydrocarbons sims

[SOP, Standard operating procedure; CA, corrective action; QC, Quality control; NA, not applicable; RPD, relative percent difference; < less than the value shown]

Laboratory QC:	Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for CA	Data Quality Objective	Measurement Performance Criteria
Medium/Matrix		Sediment				
Sampling SOP		S-02				
Analytical Parameter		Polyaromatic hydrocarbons sims				
Concentration Level		Low				
Analytical Method/SOP		PAHSOIL4.SOP				
Laboratory Name		USEPA				
Number of Sample Locations		52				
Laboratory QC:	**Frequency**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for CA**	**Data Quality Objective**	**Measurement Performance Criteria**
Method Blank	1 per batch	Concentration less than reporting level	Re-extract, see SOP	Dan Boudreau	Bias	NA
Reagent Blank	1 per batch	Concentration less than reporting level	Re-extract, see SOP	Dan Boudreau	Bias	NA
Laboratory matrix spike	1 per batch	30-140 percent	Comment	Dan Boudreau	Precision	40-160 percent
Matrix spike duplicates	1 per batch	< 50 RPD	Comment	Dan Boudreau	Precision	< 50 RPD
LCS	if available	NA	NA	NA	NA	NA
Surrogates	all samples	CLP criteria	re-analyze extract	Dan Boudreau	Precision	CLP criteria

Table 25e. Analytical Quality Control: Extractable Petroleum Hydrocarbons

[SOP, Standard operating procedure; CA, corrective action; QC, Quality control; NA, not applicable; RPD, relative percent difference; < less than the value show]

Laboratory QC:	Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for CA	Data Quality Objective	Measurement Performance Criteria
Medium/Matrix		Sediment				
Sampling SOP		S-02				
Analytical Parameter		Extractable Petroleum Hydrocarbons				
Concentration Level		Low				
Analytical Method/SOP						
Laboratory Name		Alpha Analytical				
Number of Sample Locations		52				
Laboratory QC:	**Frequency**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for CA**	**Data Quality Objective**	**Measurement Performance Criteria**
Continuous Calibration	Before sample analysis, every 8 hrs, and at end	< 25 percent difference from the initial calibration	problem must be corrected before further samples are analyzed	Ellen Collins	Precision	< 25 percent difference from the initial calibration
Reagent Blank	Before sample analysis, every 8 hrs, and at end	Concentration less than reporting level	problem must be corrected before further samples are analyzed	Ellen Collins	Bias	NA
Laboratory Method Blank	1 per 20 samples	Peak must be in the area of interest and above the reporting limit	problem must be corrected before further samples are analyzed	Ellen Collins	Bias	NA
LFB	1 per 20 samples	40-140 percent	problem must be corrected before further samples are analyzed	Ellen Collins	Precision	40-140 percent

Table 25e. Analytical Quality Control: Extractable Petroleum Hydrocarbons

[SOP, Standard operating procedure; CA, corrective action; QC, Quality control; NA, not applicable; RPD, relative percent difference; < less than the value show]

Laboratory QC:	Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for CA	Data Quality Objective	Measurement Performance Criteria
Laboratory duplicate	5 percent of total samples	< 50 percent relative percent difference	problem must be corrected before further samples are analyzed	Ellen Collins	Precision	< 50 percent relative percent difference
Matrix spike	Prior to sample analysis	40-140 percent	problem must be corrected before further samples are analyzed	Ellen Collins	Precision	40-140 percent
Matrix spike duplicate	1 per 20 samples	< 50 RPD	problem must be corrected before further samples are analyzed	Ellen Collins	Precision	< 50 RPD
Surrogates	all samples	40-140 percent	problem must be corrected before further samples are analyzed	Ellen Collins	Precision	40-140 percent

Table 25f. Analytical Quality Control: Grain Size

[[SOP, Standard operating procedure; CA, corrective action; QC, Quality control]

Laboratory QC:	Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for CA	Data Quality Objective	Measurement Performance Criteria
Medium/Matrix		Sediment				
Sampling SOP		S-01				
Analytical Parameter		Grain Size				
Concentration Level		Low				
Analytical Method/SOP		GRSIZ.SOP				
Laboratory Name		USGS Iowa Sediment Laboratory				
Number of Sample Locations		52				
Laboratory QC:	**Frequency**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for CA**	**Data Quality Objective**	**Measurement Performance Criteria**
Method blank	5-10 percent	No Target compounds greater than quantification level	Do not proceed until acceptable blank obtained	Elizabeth Shreve	Bias	No Target compounds greater than quantification level
Laboratory duplicates	1 per 20 samples	Within required precision limits defined by RPD (5 percent)	Do not proceed until acceptable value obtained	Elizabeth Shreve	Variability	Relative percent difference less than 5 percent
Performance Evaluation Samples	Occasionally	Within quantitative warning limits	Affected results are identified and samples reanalyzed of corrected for bias	Elizabeth Shreve	Bias and sensitivity	Within quantitative warning limits

Data Acquisition Requirements

Table 26. Data Acquisition Requirements

[QA/QC, quality assurance quality control]

Secondary Data	Data Source	Data Generator	How Will Data Be Used	Limitations on Data Use
Historical data concerning the use of the river	U.S. Army Corps of Engineers	U.S. Army Corps of Engineers	Historical data will be used to determine those chemicals that are likely present in sediment.	Historical records may not contain the true history of "polution"
Historical sediment quality data	U.S. Army Corps of Engineers	U.S. Army Corps of Engineers	Historical sediment quality data will be used to determine whether the chemicals of concern will be detected given the MRL of the analytical methods.	(1) Historical chemical data without proper QA/QC could be suspect (2) Limited data set
Sediment thickness	U.S. Army Corps of Engineers	U.S. Army Corps of Engineers	Sediment thickness information will be used to design sediment sampling protocols	May require additional sampling

Documentation, Records, and Data Management

Project Documentation and Records

Table 27. Project Documents and Records

[NA, not applicable]

Sample Collection Records	Field Analysis Records	Fixed Laboratory Records	Data Assessment Records
Field notes	Standards traceability logs	Chain-of-Custody	Final report
Sample collection field sheets	Equipment calibration logs	Reported results for standards, QC checks, and QC samples	Field sampling audit checklist
Cain-of-Custody	Equipment maintenance, testing and inspection logs	NA	NA

Field Analysis Data Package Deliverable

Complete field data packages will not be delivered to organizational partners (see QAPP specifics). However, all hardcopy and electronic data and information relevant to the project will be archived by the project manager in accordance with MA-RI District Admin. Memo. No. 98.01 District Data Management Policy (U.S. Geological Survey, 1997) to ensure their potential availability for future retrieval/use.

Fixed Laboratory Analytical Data Package Deliverable

- Complete fixed laboratory data packages will not be delivered by XRAL Laboratories to USGS. XRAL Laboratories will provide the raw data for review but does not generate Tier II forms used for review in the CLP program. In addition to raw data XRAL Laboratories will provide the results of all laboratory QA (table 25).
- Complete fixed laboratory data packages will not be delivered by the USGS Sediment or USEPA Laboratories to USGS, Northborough. The laboratories will; however, provide the raw data for review but will not generate Tier II forms. In addition to raw data, the laboratories will provide the results of all laboratory QA (table 25).

Data Reporting Formats

The data will be presented in a USGS Water-Resources Investigations Report that will contain bathymetry and bottom sediment thickness maps, estimates of sediment volumes, results of physical and chemical analysis of sediment, and interpretation of these data. The reports will also verify the assumptions that the data quality objectives (detection limits, bias, variability, and measurement performance criteria) were appropriate to support the project objectives. In addition, the report will discuss the quality assurance/quality control requirements and whether these requirements were met. The report will be supplemented by GIS maps in electronic and paper format. The investigators will also be available to present the findings in person to the project cooperators and interested citizens.

Data Handling and Management

- ***Data Recording:*** Field and analytical sampling results are entered from field sheets or lab reports, respectively, into the USGS NWIS database for storage and into spreadsheets for data analysis. NWIS data entry procedures are described in Quality-Assurance Plan for Water-Quality Activities in the Massachusetts-Rhode Island District Water Resources Division U. S. Geological Survey (DeSimone, 2002) and NWIS Manual (U.S. Geological Survey, 1992). All data entered by project personnel are independently checked by a second person against lab reports.
- ***Data Transformations/Data Reduction:*** All spatial data are stored and manipulated in ESRI's ARC/INFO or ARC VIEW and are projected to common Massachusetts State Plane projection.
- ***Data Analysis:*** Spatial data are processed, compiled, and analyzed in ESRI's ARC/INFO V. 7.1 or 7.0 Geographic Information System (GIS) run on a Sun-unix platform. ARC/INFO is a commonly used GIS software package for mapping. Other data analysis will be done using Microsoft Excel Spreadsheet (MSEXCEL) Software and SAS Statview statistical software. Examples of these data analysis include: calculation of sample population description statistics (for example, mean, median, percentile of concentration data). The specific analysis procedures will be determined by characteristics of the data collected in accordance with Helsel and Hirsch (1991).
- ***Data Assessments:*** Sediment quality data will be validated by comparison of reported values with measurement performance criteria (table 11), sample quality control criteria (table 23), analytical quality control (table 25), by visual inspection (for example, comparison of performance evaluation samples with quantification levels for target compounds), and calculation of numerical criteria such as relative percent difference (RPD) of field duplicates. Attainment of RPDs per criteria will be tracked in a spreadsheet (MSEXCEL) such that overall project variability, data completeness, and data comparability can be readily calculated.

Data Tracking and Control

Site information and sediment-quality data are stored in the central project file for the duration of the project and in the USGS NWIS data bases following District guidelines (U.S. Geological Survey, 1997). All data will be reviewed by the project manager and project QA officer (table 5) for accuracy. The USGS water-quality specialist will review data summaries and final reporting of data. Sediment-quality data will be published in the final report. Project files will be archived in accordance with MA-RI District Admin. Memo. No. 98.01 District Data Management Policy (U.S. Geological Survey, 1997).

ASSESSMENT AND OVERSIGHT ELEMENTS

Assessments and Response Actions

Planned Assessments

The following assessments will be performed periodically throughout the project to ensure that usable data are generated.

Table 28. Project Assessment

[USGS, U.S. Geological Survey; USEPA, U.S. Environmental Protection Agency]

Assessment Type	Frequency	Internal	Organization	Person(s) responsible
Field sampling technical systems audit	At start-up of sampling	Internal	USGS	Robert Breault
Data package technical systems audit	Completion of project	Internal	USGS	Robert Breault
Data management systems review (U.S. Geological Survey, 1995)	Four times throughout the project	Internal	USGS	Robert Breault
Technical review	Three times throughout the project	Internal	USGS	Robert Breault
Sampling and analysis audit	Periodically throughout the project	Internal	USGS	Robert Breault
Data validation technical systems audit	Completion of project	Internal	USGS	Robert Breault

Assessment Findings and Corrective Action Responses

If it is found through planned project assessments (table 28) that there are QAPP deviations or project deficiencies, the results of the planned project assessments will immediately be reported to the persons listed in table 2 through verbal debriefing or written reports. The appropriate response to address non-conformances will be chosen in consultation with those persons. Appropriate corrective action responses to ensure that the data quality is adequate for its intended use can include all or some of the following actions, (1) system audit for analyte in question, (2) determination of matrix interference, (3) reconstruction of acceptable limits with statements explaining the results of the action or rationale taken, (4) rejection of data and exclusion from the report with written explanation, (5) rejection of the entire sample or site location with recommendation of relocation of the sample site or reconsideration of the results, and (6) revision of SOPs.

The corrective action decided upon will be implemented and directed by the project manager (table 2). Because many of these corrective actions involve modification of the original QAPP, all modifications will be documented and submitted for approval in the same manner as the original QAPP in accordance with Region I, EPA-New England Compendium of Quality Assurance Project Plan Guidance, U.S. EPA-New England Region I, Quality Assurance Unit Staff, Office of Environmental Measurement and Evaluation, September 1998, Draft Final (U.S. Environmental Protection Agency, 1998). Project personnel listed in table 4 are authorized to initiate procedural modification the original QAPP. All amendments/changes to the original QAPP (Document Control Number USGS442519400) will be immediately incorporated into the final version of the QAPP, distributed to those persons listed in tables 2 and 3, and will be maintained by the U.S. Geological Survey as a part of the project files in accordance with MA-RI District Admin. Memo. No. 98.01 District Data Management Policy (U.S. Geological Survey, 1997). Only after the modification has been approved can the change be implemented. Initial verbal approval may be used to expedite project work; however, the QAPP modification must be documented immediately and submitted for formal approval.

Additional Quality Assurance Project Plan Non-conformances

Deviations from the approved QAPP identified by project personnel outside of the formal assessment process will immediately be reported to the project manager (table 2). Such incidents will be documented and resolved using the procedures that were detailed for planned assessments in section

"Planned Assessments" and "Assessment Findings and Corrective Action Responses" of the Neponset River QAPP.

Quality Assurance Management Reports

Table 29. Quality Assurance Management Report

Type of Report	Frequency	Delivery Date	Persons Responsible	Report Recipient
Verbal status reports	Upon request	Not applicable	Robert Breault	See section QAPP Specifics
Written status reports	Quarterly	Quarterly	Robert Breault	See section QAPP Specifics
[1]Final report	After completion of data collection and all reviews	07/01/03	Robert Breault	See section QAPP Specifics

[1] The final report will include (1) development of project quality objectives, (2) summary of major/critical problems encountered and their resolution, (3) data summary (tables, charts, and graphs), (4) reconciliation of project data with project quality objectives, (5) conclusions, and (6) a discussion of the QA/QC

DATA VALIDATION AND USEABILITY ELEMENTS

Verification and Validation Requirements

The laboratory data will not be verified and validated using Tier II data validation by the analyzing agencies in accordance with the Region I, EPA-New England Validation Functional Guidelines for Evaluating Environmental Analysis. A tier II like validation will be done by the project QA officer. The laboratories will only provide raw data. The laboratories is exempt from generating Tier II forms used in the CLP program.

Sediment samples will be reviewed based on the percentage of solids measured in each sample according to EPA-New England Validation Functional Guidelines for Evaluating Environmental Analysis following these USEPA guidelines;

- accept data for samples with greater than 30 percent solids
- reject non-detects and estimate positive detects for sediment samples with less than 30 percent solids but greater than 10 percent solids
- reject all data if sediment samples are less than 10 percent solids.
- discuss sampling techniques and determine their applicability.

Verification and Validation Procedures

Table 30. Data Validation Summary

[PCBs, polychlorinated biphenyls; USGS, U.S. Geological Survey]

Medium/ Matrix	Analyte	Concen-tration Level	Validation Criteria	Valida-tion Criteria modified	Data Valida-tion Tier Level	Mod-ified Tier Level Used	Data Validator	Responsibility for data validations
Water	PCBs	Low	Region I, EPA-New England Validation Functional Guidelines for Evaluating Environmental Analysis	Y	II	Y	Robert Breault, USGS	Robert Breault, USGS
Bottom sediment	Organics	Low	Region I, EPA-New England Validation Functional Guidelines for Evaluating Environmental Analysis	Y	II	Y	Robert Breault, USGS	Robert Breault, USGS
Bottom sediment	Trace elements	Low	Region I, EPA-New England Validation Functional Guidelines for Evaluating Environmental Analysis	Y	II	Y	Robert Breault, USGS	Robert Breault, USGS
Bottom sediment	Grain-size	Low	Region I, EPA-New England Validation Functional Guidelines for Evaluating Environmental Analysis	Y	II	Y	Robert Breault, USGS	Robert Breault, USGS

Data Usability and Reconciliation With Project Objectives

A data quality assessment will be conducted as described in Guidance for the Data Quality Assessment Process: Practical Methods for Data analysis, EPA QA/G-9, July 1998 (www.epa.gov/swerust1/cat/epaqag9.pdf) and Helsel and Hirsch (1991). Briefly, this data quality assessment will consist of five steps including

- review of sampling design
- conduct preliminary data review
- select statistical tests
- verify assumptions
- draw conclusions from the data.

The data will be presented in an USGS Water-Resources Investigations Report that will contain bathymetry and bottom sediment thickness maps, estimates of sediment volumes, results of physical and chemical analysis of sediment, and interpretation of these data. The report will also verify the assumptions that the data quality objectives (detection limits, precision, accuracy, and measurement performance criteria) were appropriate to support the project objectives. In addition, the report will discuss the quality assurance/quality control requirements and whether these requirements were obtained. The report will be supplemented by GIS maps in electronic and paper format. The investigators will also be available to present the findings in person to the project cooperators and interested citizens.

- ***Project Variability:*** Project analytical and overall variability will be determined by inspecting field and laboratory duplicates. If large variability is indicated then the source will be determined by investigating field sampling rational, sampling techniques, and other factors. Once determined, the data will be appropriately qualified.
- ***Sample Bias:*** Sample bias will be assessed by inspecting performance evaluation samples and laboratory blanks and addressed in the final report. Additionally, the final report will describe the limitations of the use of data if extensive contamination bias exists or when limited to a specific sampling of laboratory/analytical group, data set, analytical parameter, or concentration level.
- ***Sample Representativeness:*** Sample representativeness will be assessed for each parameter, and concentration level using analysis audits. The final report will describe the limitation on the use of

project data if overall non-representative sampling has occurred, or when non-representative sampling is limited to a specific sampling group, data set, analytical parameter, or concentration level.

- ***Data Completeness:*** Data completeness will be assessed by determining the percentage of the number of valid measurements that were collected for each analytical parameter and concentration level.
- ***Data Limitations and Actions:*** When it is found that the data do not meet the project quality objectives, the project manager may determine that one or more of the following procedures for corrective action shall be undertaken, (1) incomplete data: omission from logs, notebooks and worksheets place the entire analysis in question. If data do not meet the 80 percent data completeness requirement, a meeting will be held with the USGS water-quality specialist to determine an appropriate response. Incomplete field sampling data may require resampling of the questionable sample if feasible; (2) conflicting or poor quality data: when results from field duplicates, replicates, spikes, holding times, field instrument calibration, or other parameters do not meet the described QC goals (table 23), the available data will be reviewed by the project manager. Upon examination, all or some of the following actions may be applied, (1) system audit for analyte in question, (2) determination of matrix interference, (3) reconstruction of acceptable limits with statements explaining the results of the action/rationale taken, (4) rejection of data and exclusion from the report with written explanation, and (5) the data will be evaluated.

REFERENCES

Breault, R. F., Weiskel, P.K., and McCobb, T.D., 2000, Channel morphology and streambed-sediment quality the Muddy River, Boston and Brookline, Massachusetts, October 1997.

Colman, J.A., 2000, Source identification and fish exposure for polychlorinated biphenyls using congener analysis from passive water samplers in the Millers River Basin, Massachusetts: U.S. Geological Survey Water-Resources Investigations Report 00-4250, 44 p.

DeSimone, L.A., 2002, Quality-Assurance Plan for Water-Quality Activities in the Massachusetts-Rhode Island District Water Resources Division U. S. Geological Survey: Northborough, Massachusetts.

Mueller, D.K., 1998, Quality of nutrient data from streams and ground water sampled during 1993-95-National Water-Quality Assessment Program, U.S. Geological Survey, Open-File Report 98-276, 25 p.

Radtke, D.B., 1997, Chapter A8. Bottom-sediment samples, *in* Wilde, F.D., Radtke, D.B., Gibs, J., and Iwatsubo, R.T., eds., National Field Manual for the Collection of Water-Quality Data: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 9, chap A8, variously paginated.

Scott, J.C., 1990, Computerized stratified random site-selection approaches for design of a ground-water-quality sampling network, U. S. Geological Survey, Water-Resources Investigations Report, 90-4101. 109 pp.

U.S. Environmental Protection Agency, 1998, Region I, EPA-New England Compendium of Quality Assurance Project Plan Guidance: U.S. EPA-New England Region I, Quality Assurance Unit Staff, Office of Environmental Measurement and Evaluation, September 1998, Draft Final.

U.S. Geological Survey, 1992, National water information system user's manual, volume 2, chapter 2, water-quality systems, version 91.2: U.S. Geological Survey, Reston VA. variously paginated.

-----, 1995, Programs and plans-- 10/40/70 project review process: U.S. Geological Survey Massachusetts-Rhode Island District Policy, 4 pp.

-----, 1997, Policies and Procedures--District Data Management Policy: U.S. Geological Survey Massachusetts-Rhode Island District Administration Memorandum No. 98.01, 42 pp.

Wilde, F.D., Radtke, D.B., Gibs, Jacob, Iwatsubo, R.T., 1999, Processing of water samples, *in* Wilde, F.D., Radtke, D.B., Gibs, J., and Iwatsubo, R.T., eds., National Field Manual for the Collection of

Water-Quality Data: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 9, chap A5, variously paginated